Cornell University

THE CALDWELL COLLECTION

THE GIFT OF THE FAMILY OF
GEORGE CHAPMAN CALDWELL
TO THE
DEPARTMENT OF CHEMISTRY
whose senior Professor he was from 1868 to 1903

4513

Reports on milk etc.

3 1924 003 043 639 mann

Cornell University Library

The original of this book is in the Cornell University Library.

There are no known copyright restrictions in the United States on the use of the text.

http://www.archive.org/details/cu31924003043639

ADVANCE SHEETS

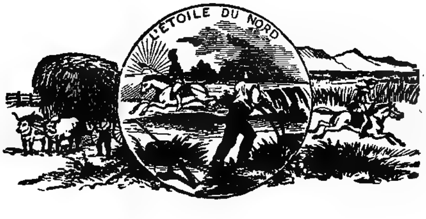
OF THE

FIFTH BIENNIAL REPORT

OF THE

MINNESOTA
STATE DAIRY AND FOOD
COMMISSIONER.

From August 1, 1892 to November 30, 1893.



MINNEAPOLIS:
HARRISON & SMITH, STATE PRINTERS,
1894.

5

Minnesota State Dairy and Food Commission.

Berndt Anderson,	Commissioner.
E. J. Graham,	Assistant Commissioner.
A. H. Bertram,	Assistant Commissioner, and Secretary.
E. N. Eaton.	Chemist.
H. A. Hokemeier,	Inspector.
P. W. Wildt	Inspector.
E. B. Williams,	Inspector.
J. M. Bohrer,	Inspector.
C. B. Davis,	Inspector.

REPORT OF THE DAIRY AND FOOD COMMISSION.

STATE OF MINNESOTA,
OFFICE OF THE STATE DAIRY AND FOOD COMMISSIONER,
St. Paul, December 1, 1893.

To the Honorable Knute Nelson, Governor of Minnesota:

SIR:—In conformity with the custom of this department, established since its creation, of making periodical reports during the interval between the issue of the biennial reports provided for by law, I now formally report to you the work performed by this department, in the form of "advance sheets" of the next biennial report, covering the period since the last report up to the present time, (Dec. 1, 1893).

In so doing this report will include the work of my predecessor, Hon. A. K. Finseth, up to the time of the confirmation of my appointment by the Senate as State Dairy and Food Commissioner, which occurred on the 27th day of January, 1893, and from that time until the present, of the work performed under my direction.

Before the passage of any food laws, this department was granted an appropriation of fifteen thousand dollars or so much thereof as was necessary for the enforcement of the dairy laws. This work consisted of inspecting all milk sold within the state to creameries, cheese factories and private families, and to prevent the importation and sale of any dairy products not conforming to the provisions of existing laws. But the Legislature of 1890, extended the work of the department by adding to its duties the inspection of such food products as lard, baking powder, vinegars and spirituous and malt liquors, and for the prosecution of these additional articles, the sum of three thousand dollars was annually appropriated. This sum was inadequate in the extreme as the whole state of Minnesota was to be covered in the prosecution of the work, and as there had never been any laws regulating the standard of excellence of these products enacted in this state, it is worthy of presumption, that the spurious far exceeded the genuine on our markets; but with this sum at our disposal the work of renovation was commenced, and a most vigorous warfare it was, and after two years of vigilance the markets of the state were purified to the extent that consumers now need not be swindled in purchasing any of the foods specified in our laws. Colored vinegars are banished from the state, and therefore do not come in competition with cider vinegar it so much resembles. Baking powders containing alum are so branded and sold on their merits. We have to watch the lard market very close as there are yet some frauds practiced by adulterating it with tallow, but it is not practiced to the extent it was when the law took effect. The vigilance of the department will continue in all these lines until a desired result is brought about. When the food laws were enacted and placed in the hands of this department for enforcement we found a worse condition in those lines than we had dared expect, and was compelled to enlist the entire force of the department in this work of extermination, and to accomplish the result, we could not give the dairy interests of the state the attention it was entitled to receive, but we viewed the matter philosophically and decided that after the food market had once been renovated, both the dairy and food interests could be looked after; in justice to both, this view has been verified. Since the issue of our last biennial report for the period ending July 31, 1892, we have made the dairy interests our special care. The creameries and cheese factories have never in the history of the department had such careful inspection as during the past year, the results of which have been very satisfactory. For two years previous to this we have at the solicitation of the managers of cheese factories and also of the State Dairymens Association, placed a cheese instructor in the field in order to bring about more uniform results; the wisdom of this course has been fully justified by the results that have accrued. But since the farm school has been established, in order not to assume any of their duties, we have withdrawn our instructor and refer all parties to the farm school, of which we are justly proud, for instruction in all dairy matters. We were well aware, that when the department placed an instructor in the field, that we were exceeding our authority in the matter, as the dairy and food department was entirely a police and not an educational department. We are therefore glad to relieve ourselves of this branch of work and place it in the hands of a purely educational institution, viz: "The Minnesota Farm School," thereby allowing the dairy and food department to confine itself entirely to duties for which it was created.

I will now take up the various dairy and food products, the enforcement of which comes within our jurisdiction, and report on each article in their order and accompany the same with statements in tabulated form, with reference to the amount of work done in each particular line and their condition as to purity. I do not intend at this time to make an extended report, but to place the work of the department before the public in a clear and terse form that all interested may know of the scope and magnitude of the work required of this department, and how well the duty is performed and the interests of all concerned are cared for, all of which is most respectfully submitted for your consideration and approval.

Most respectfully,

BERNDT ANDERSON, Commissioner.

MILK.

The dairy and food department comes more directly in contact, in the prosecution of its work, with this one article of food and diet, than with any other with which it is called upon to deal. It is a commodity that enters into every household, the rich and the poor are alike consumers, and it therefore becomes doubly important that it should receive our untiring watchfulness, to prevent adulteration in any particular. It is the food entirely depended upon by a large portion of the infants of the country and their health and growth largely depend upon a pure and healthful article free from all impurities. It is a luxury enjoyed by old and young alike and especially sought after during the warm months. A cool glass of milk on a hot day in its natural freshness and purity is a nectar fit for the gods. The laws of Minnesota regulating the sale of milk are very good as far as they go, but do not extend far enough. They were enacted more with a view of establishing a standard of richness, below which milk could not be sold, than for any other purpose, thereby preventing the placing upon the market, by unprincipled vendors, skimmed or watered milk. Now that this has been successfully accomplished, I would recommend that the laws of the state be so amended, that all milk sold upon our markets should be pasteurized in order to destroy any bacteria or disease germs that might be contained therein. Milk is probably more susceptible of contamination than any other article of food we use, and too much care cannot be taken with reference to its environments. Pasteurization (from Dr.

Pasteur, a French scientist,) of milk is a process not so well known as sterilizing, and unfortunately (see N. J. Dairy Com'r Report 1891, pp. 133) one which is not so simple in its accom plishment. It consists ordinarily in heating milk to a temperature of 70°c, to 80°c (158° to 176° F.), and then rapidly cooling. Various forms of apparatus have been devised for the purpose, though none of them are adapted for accomplishing the operation easily on a small scale. In some of the forms of apparatus the milk is brought in contact with thin metal sheets, which are warmed to the required temperature by steam. The best form of apparatus is one described by Bitter (Zeit für Hyg., 1890.) It consists essentially of a large metal vessel containing a coil of pipes, which can be supplied with steam. In the vessel are also some paddles, which can be readily revolved by turning a crank. After the milk is placed in the vessel, the steam is turned on and paddles set in motion. The motion of the paddles keeps the milk circulating and insures a uniform heating. The temperature rises rapidly, and the steam is kept in the coil until the desired temperature is reached and then turned off again. If it is only desired to heat the milk for a moment, the milk is now taken out of the vessel and rapidly cooled with ice. If, however, it is desired to continue the heating for a short time, the milk is allowed to remain in the vessel, and a small amount of steam allowed to pass through the coil as long as desired. By a little care the temperature can be kept constant for a long time, with almost no variation. In all cases the milk is taken from the apparatus after heating is finished, and cooled as rapidly as possible.

Milk heated in this way will become completely sterilized, and all pernicious bacteria found in the milk be completely destroyed. It is claimed that typhoid germs are killed at 58° to 59°, pneumonia germs at 55° to 60°, vaccine at 60°, and tuberculosis germ at 69°. The heat ing must be kept up for a half hour to destroy the tuberculosis germ, but the others succumb in a much shorter period. Whether this process or the simpler process of sterilizing is employed is yet to be decided upon, but a process with a view of destroying disease germs must sooner or later be adopted.

Cleanliness in the handling of milk is of the utmost importance and has much to do with its keeping qualities. Before beginning to milk, the udder should be thoroughly brushed (washing is still better) so that all dirt and particles may be thoroughly removed. The hands should be kept dry during the process, never dipping them in the milk and wetting the teats, as the drippings fall back into the milk, contaminating it. As soon as the pail is full it should be removed, strained and cooled as quickly as possible, never allowing it to set in the barn a moment longer than necessary, as it will absorb the odors surrounding it in an inconceivably short space of time, and that odor will follow it into the butter or whatever it may be converted into, and no known process will exterminate it. Cleanliness in and about the barns and stables is of the utmost importance, as the health of the cows are dependent upon it, and good, wholesome, healthy milk can be obtained only from healthy cows. Feeding is another important essential in the production of good dairy products. Brewers malt, vinegar waste or any fermented food should under no conditions be given the cow, as it creates fever in the animal, and the milk is readily affected thereby.

It is to be regretted that the nations of the world that make any pretence at dairying, do not pattern more closely after the thorough system employed in Denmark and Sweden. The cow is treated as a dear friend, her every want and whim supplied. The barns are models of cleanliness that present the attractions of a home. Danish and Swedish girls neatly and prettily dressed do the milking, this fact alone assures kind treatment, rather than the use of a heavy boot or the vigorous application of a milking stool at the hands of a heartless wretch, demanding obedience from a slow moving cow.

The laws in those countries are rigidly enforced, and are very exacting. The milk is not only inspected with reference to its richness, but also its sanitary condition as well. The result of this system, maintained through a long series of years, has placed the dairy products of our Danish and Swedish friends far beyond the reach of competition of any other nation on earth. There is no valid reason why the United States, and more especially Minnesota with all her rich natural advantages, of pure air, water, grass, and indomitable pluck and courage of its farmers and dairymen, together with the improved appliances at hand, should not inaugurate a system of dairying, and strictly adhereing to it, compel the pretty dairy maids of Denmark and Sweden to at least divide the laurels during the years to come.

Herewith I will call attention to the following table, which represents the number of samples of milk inspected at Minneapolis, St. Paul, Duluth, Winona, Stillwater, St. Cloud and other towns, also including milk sent into the cities on the various lines of railroad. This table does not however include milk inspected at cheese factories and creameries which will follow later on.

Numbers of sample of milk inspected from August 1st, 1892, to December 1st, 1893, by month:

Month.	Year.	Samples Inspected.	Average Fat.
August	1892	69	3.72
September	1892	68	3.86
October	1892	118	3.67
November	1892	43	3.97
December	1892	98	3.66
January	1893	117	3.75
February	1893	190	3.67
March	1893	431	3.60
April	1893	132	3.61
May	1893	166	3.54
June	1893	297	3.51
July	1893	172	3.67
August	1893	216	3.47
September	1893	186	3.69
October	1893	192	3.82
November	1893	129	3.80
Total for 16 months		2,644	3.68¾

Following this table find report of inspection of cheese factories and creameries giving location, name of manager or proprietor, name of inspector and the average standard of the milk inspected, the conditions of which are very gratifying.

INSPECTION OF CREAMERIES.

Date.		Name of Creamery.	Post Office.	County.	Proprietor or Manager.	By Whom Inspected.	Average Fat.
1892							
Aug.	2	Fairpoint	Fairpoint	Dodge	L. W. Holt, manager	H. A. Hokemeier	3.39
"	2	Oronoco	Oronoco	Olmsted	McCray Bros., managers	E. B. Williams	3.40
"	3	Kenyon	Kenyon	Goodhue	P. J. Gutzler, manager	H. A. Hokemeier	3.70
"	4	Spring Creek	Kenyon	Goodhue	P. J. Gutzler, manager	H. A. Hokemeier	3.63
"	8	Kenyon	Kenyon	Goodhue	Crescent Creamery Co.	H. A. Hokemeier	3.49
"	5	Wanimingo	Wanamingo	Goodhue	Crescent Creamery Co.	H. A. Hokemeier	3.34
"	9	Aspelund	Aspelund	Goodhue	Crescent Creamery Co.	H. A. Hokemeier	3.53
"	10	Richland	Richland	Rice	Crescent Creamery Co.	H. A. Hokemeier	3.52
"	11	Maland	Maland	Rice	Crescent Creamery Co.	H. A. Hokemeier	3.48
"	12	Wheeling	Wheeling	Rice	John Finstad	H. A. Hokemeier	3.61
"	15	Nerstrand	Nerstrand	Rice	Co-operative	H. A. Hokemeier	3.53
"	16	Cannon Falls	Cannon Falls	Goodhue	H. Youman	H. A. Hokemeier	3.55
"	17	Heron Lake	Heron Lake	Jackson	W. H. Kessler	H. A. Hokemeier	3.87
"	17	Randolph	Randolph	Dakota	F. Schoonover	E. B. Williams	3.74
"	18	St. James	St. James	Watonwan	Farmers' Co-operative	J. V. Wilson	3.63
"	19	Madelia	Madelia	Watonwan	John McCarthy, secretary	H. A. Hokemeier	3.60
"	24	New Chicago	Wolcott	Rice	P. O. Larson	H. A. Hokemeier	3.54
"	25	Hazelwood	Hazelwood	Rice	Wm. Morton	E. B. Williams	3.53
"	26	Faribault	Faribault	Rice	C. E. Taylor	H. A. Hokemeier	3.38
"	29	Wolcott	Wolcott	Rice	F. A. Berry	H. A. Hokemeier	3.66
"	30	Dean	Dean	Rice	A. Waldoron	H. A. Hokemeier	3.62
Sept.	17	Blooming Prairie	Blooming Prairie	Steele	Geo. Johnson	E. B. Williams	3.62
"	22	Union	Blooming Prairie	Steele	J. K. Bennett	E. B. Williams	3.49
"	23	Geneva	Geneva	Freeborn	J. M. Sawyer	E. B. Williams	3.55
"	24	Bixby	Bixby	Steele	P. P. Thimsen	E. B. Williams	3.70
"	26	Grogan	Grogan	Watonwan	Wm. Moser	E. B. Williams	3.55
1893							
April	13	Biscay	Biscay	McLeod	Co-operative	E. J. Graham	3.71
May	18	Owatonna	Owatonna	Steele	Geo. Barkis	E. B. Williams	3.76
"	20	Owatonna	Owatonna	Steele	John Virtue	E. B. Williams	3.48
"	26	Bixby	Bixby	Steele	J. J. Dayton	E. J. Graham	3.44
"	26	Moscow	Moscow	Freeborn	Chas. Rettig	E. B. Williams	3.70
"	27	Blooming Prairie	Blooming Prairie	Steele	Co-operative	E. J. Graham	3.25
"	29	Red Oak Grove	Lansing	Mower	Halvor Thompson	E. B. Williams	3.61
June	6	Goodhue	Goodhue	Goodhue	Co-operative Co.	E. J. Graham	3.70
"	7	Claremont	Claremont	Dodge	Disbrow Bros	E. B. Williams	3.51
"	8	Dodge Centre	Dodge Centre	Dodge	Ace Webster	E. B. Williams	3.80
"	16	Grove City	Grove City	Meeker	Co-operative	E. J. Graham	3.81
"	23	Frontenac	Frontenac	Goodhue	J. S. Goff, secretary	E. B. Williams	3.97
July	19	Hector	Hector	Renville	Co-operative	E. J. Graham	4.07
"	24	Albert Lea	Albert Lea	Freeborn	C. M. Ruble	E. B. Williams	3.62
"	25	Armstrong	Armstrong	Freeborn	Geo. Widman	E. B. Williams	3.72
"	26	Alden	Alden	Freebron	A. Robinson	E. B. Williams	3.63
Sept.	16	Pratt	Pratt	Steele	A. Volker	E. B. Williams	3.60

INSPECTION OF CHEESE FACTORIES.

Date,		No of Fact.	Name of Factory.	Post Office.	County.	Manager or Proprietor.	By Whom Inspected.	Average Fat.
1892.								
August	1	5	Berne Cheese Factory	Berne	Dodge	Crescent Creamery Co.	E. B. Williams	3.32
"	3	62	Pine Island	Pine Island	Goodhue	Crescent Creamery Co.	"	3.53
"	16	125	County Line	Alma City	Waseca	E. A. Comstock	"	3.71½
"	24	102	Wilder	Wilder	Jackson	W. S. Trowbridge	"	3 53
"	25	68	Bergen	Bergen	Jackson	S. J. Skove	"	3.55
"	26	7	Storden	Storden	Cottonwood	Frank Tripp	"	3.45
"	27	155	St. Michaels	St. Michaels	Wright	Michels & Holzman	"	3.73
"	29	85	Sauk Centre	Sauk Centre	Stearns	A. Miller	"	3.92
October	1	1	Fergus Falls	Fergus Falls	Otter Tail	W. L. Chappell	"	3.72
"	3	29	Western	Western	Otter Tail	T. B. Roberts	"	3.82
Dec.	16	41	Havanna	Havanna	Steele	L. A. Disbrow	"	3.54½
1893.								
May	19	41	Havanna	Havanna	Steele	L. A. Disbrow	"	3.35
"	24	20	Turtle Creek	Lansing	Mower	E. B. Williams	"	3.46
June	6	99	West Concord	West Concord	Dodge	Frank Bailey	"	3.44
"	9	3	Byron	Byron	Olmsted	Crescent Creamery Co.	"	3.64
"	10	2	Olmsted	Olmsted	Olmsted	Crescent Creamery Co.	"	3.47
"	13	18	Rock Dell	Rock Dell	Olmsted	Marcus Wing	"	3.57½
"	15	4	Pine Island	Pine Island	Goodhue	Crescent Creamery Co.	"	3.58½
"	16	5	Berne	Berne	Dodge	Crescent Creamery Co.	"	3.40
"	17	28	Pleasant Valley	Roscoe	Goodhue	K. Stuckey	"	4.26
"	20	110	Stanton	Stanton	Goodhue	N. Daniels	"	3.44
"	21	96	Hampton	Hampton	Dakota	John Delfield	"	3.54½
"	28	155	St. Michaels	St. Michaels	Wright	Michels & Holzman	"	3.65
"	27	160	Eureka	St. Michaels	Wright	E. D. Washburn	"	3.66
"	29	158	Hanover	Hanover	Wright	Michels & Holzman	"	3.68
"	30	159	Elm Grove	St. Michaels	Wright	Michels & Holzman	"	3.89
July	5	21	Lansing	Lansing	Mower	H. M. McIntyre	"	3.61
"	6	33	New Richland	New Richland	Waseca	Henry Jaehning	"	3.69
"	8	125	County Line	Alma City	Waseca	E. A. Comstock	"	3.85
"	12	44	Lake Crystal	Lake Crystal	Blue Earth	Geo. V. Norman	"	3.94
"	13	......	Good Thunder	Good Thunder	Blue Earth	Sahre & Henkel	"	3.81
"	19	136	New Rome	Gaylord	Sibley	G. Mouthy	"	3.56
"	20	112	N. Redwood	Redwood Falls	Redwood	Chas. Fleischer	"	3.73
"	21	118	Sumpter	Sumpter	McLeod	C. E. Barnum	H. A. Hokemeier	3.54
"	21	140	Eagle Lake	Eagle Lake	Blue Earth	S. V. Perry	E. B. Williams	3.76
"	22	......	Hector	Hector	Renville	A. A. Helstad	"	4.06
"	26	141	Cedar Mills	Cedar Mills	Meeker	G. Welch	"	3.75
"	27	120	Acoma	Acoma	McLeod	H. Schulz	"	4.00

INSPECTION OF CHEESE FACTORIES.—*Continued.*

Date.	No. of Fact.	Name of Factory.	Post Office.	County.	Manager or Proprietor.	By Whom Inspected.	Average Fat.
1893.							
July 28	97	Biscay	Biscay	McLeod	O. Johnson	E. B. Williams	3.76
August 5	115	Villard	Villard	Pope	O. B. Butler	"	3.86
" 8	1	Fergus Falls	Fergus Falls	Otter Tail	W. L. Chappell	"	3.50
" 11	29	Western	Western	Otter Tail	T. B. Roberts	"	3.96
" 12	33	New Richland	New Richland	Waseca	Henry Jaehning	"	3.43
" 14	123	Willmar	Willmar	Kandiyohi	H. A. Blood	"	3.87
" 17	133	Union Hill	Union Hill	Scott	M. T. Schmitz	"	4.79
" 19	16	New Market	New Market	Scott	John Remitzer	"	3.56
" 22	26	Medford	Medford	Steele	Crescent Creamery Co.	"	3.66
" 23	42	Oakland	Oakland	Freeborn	W. Willison	"	3.62
Sept. 6	149	Minnesota Lake	Minnesota Lake	Faribault	P. F. Wendt	"	3.61
October 8	123	Willmar	Willmar	Kandiyohi	H P. Dahl	"	3.86

Referring to the reports of the Dairy commissioners of the states of Massachusetts, Michigan, New York, New Jersey, Vermont and Wisconsin, my attention is called to the milk standard adopted by those states and will give it for the information of those interested.

MINNESOTA.

Water	87.
Solids	13.
Butter fat	3.5

MASSACHUSETTS.

Water	87.
Total solids	13.
Solids, not fat	9.3

MICHIGAN.

Water	87.50
Total solids	12.50
Fats	3.

NEW YORK.

Water	88.
Total solids	12.
Fat	3.

NEW JERSEY.

Water	88.
Solids	12.

VERMONT.

Total solids	12.5
Solids, not fat	9.25

WISCONSIN.

Butter fats	3.

The specific gravity of normal milk at 60° F ranges from 1,029 to 1,033. Skimmed milk at the same temperature has a specific gravity of from 1,033 to 1,040. The specific gravity of watered milk is from 1,027 downwards in accordance with the amount of water the milkman's conscience will allow him to use, and that amount varies with the milkman.

You will perceive at a glance that the standards for butter fats is higher in Minnesota than in any of the others. I fail to see the reason that it should not be placed at 3.5 per cent. in all the states. It cannot be that the wild pasturage of this state is more nutritious than the tame pastures of the older states. The milk gathered by our Inspectors show tests every day where it ranges from 4.00 to 5.50 per cent., and very seldom below 3.50, unless it has been tampered with. It was thought when the Minnesota standard was adopted, that 3.5 was excessive, but after eight years experience, we are satisfied that it is none too high. This high standard has been the cause of bringing a better grade of cows into our state, and purging it of the useless and expensive scrub. The cheese factories and creameries of the state have adopted the best plan in buying their milk: a person now gets what his milk is worth in fats, and it is the only honest way of dealing in this commodity and insuring even handed justice to all the patrons.

The following list of cases were tried before the municipal and district courts of Hennepin and Ramsey counties, for adulteration of milk, both by skimming and adding water, and also for failing to procure a license before engaging in the sale of milk, all of which is in violation of the laws of the state:

State of Minnesota vs. O. F. Chamberlain, in municipal court at Minneapolis, Minn. Warrant issued March 27, 1893; case tried before Judge Mahoney; defendant plead guilty of selling milk adulterated with water, as charged; fined $25 and costs. Witnesses: H. A. Hokemeier, J. M. Bohrer and E. N. Eaton.

State of Minnesota vs. H. C. Johnson, in municipal court at Minneapolis, Minn. Warrant issued April 3, 1893; case tried before Judge Elliott; defendant plead guilty of having sold milk which had been skimmed. as charged in the complaint, and was fined $25 and costs. Witnesses: H. A. Hokemeier, E. N. Eaton and C. B. Davis.

State of Minnesota vs. R. Hanson, in municipal court at Minneapolis, Minn. Warrant issued April 3, 1893; case tried before Judge Elliott; defendant plead guilty of having sold adulterated milk as charged and was fined $25 and costs. Witnesses: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. D. D. Sullivan, in municipal court at Minneapolis, Minn. Warrant issued June 21, 1893; case tried before Judge Elliott; defendant charged with selling milk without a license, found guilty and fined $10 and costs. Witness: H. A. Hokemeier.

State of Minnesota vs. Chris. Nelson, in municipal court at Minneapolis, Minn. Warrant issued June 22, 1893; case tried before Judge Elliott; defendant charged with selling milk without a license, found guilty and fined $10 and costs, $5 remitted. Witness: H. A. Hokemeier.

State of Minnesota vs. P. E. Neilson, in municipal court at Minneapolis, Minn. Warrant issued June 22, 1893; case tried before Judge Elliott; defendant charged with selling milk without a license, as charged; fined $25 and costs, $15 remitted. Witnesses: C. B. Davis and E. N. Eaton.

State of Minnesota vs. John Miller. in municipal court at Minneapolis. Warrant issued June 22, 1893; case tried before Judge Elliott; defendant found guilty of selling illegal milk and was fined $25 and costs: $15 remitted. Witnesses: C. B. Davis and E. N. Eaton.

State of Minnesota vs. Jens Hanson, in municipal court at Minneapolis. Warrant issued July 11, 1893; case tried before Judge Mahoney; defendant charged with having refused to procure license for the sale of milk; was found guilty as charged, and on his taking out a license the case was dismissed. Witness: H. A. Hokemeier.

State of Minnesota vs. H. Simonson, in municipal court at Minneapolis. Warrant issued July 25, 1893; case set for July 28th; defendant charged with having sold adulterated milk; defendant appeared and waived examination, was bound over to the grand jury; case still pending. Witness: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. J. H. Kroohn, in municipal court, Minneapolis. Warrant issued July 25, 1893; case set for July 29th; defendant charged with having sold adulterated milk; appeared at the time set, waived examination and was bound over to the grand jury; case still pending. Witnesses: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. M. N. Graham, in municipal court at Minneapolis. Warrant issued August 30, 1893; case called August 31st; charged with refusing to procure a license for the sale of milk; defendant appeared and procured a license; fined $10.00 and costs, fine remitted.

State of Minnesota vs. George Staples, in district court, Ramsey county, Minn. Warrant sworn out September 26, 1893; charged with selling watered milk; indictment found by grand jury; case came before the October term of court; defendant appeared, plead guilty and was fined $20.00 and costs. Witnesses: E. J. Graham, E. N. Eaton and J. M. Bohrer.

State of Minnesota vs. James McGrath, in district court of Ramsey Co., Minn. Warrant sworn out by J. M. Bohrer, September 26, 1893; indictment found by grand jury; case came before the October term of the district court; defendant appeared and plead guilty of having sold watered milk; was fined $20.00 and costs. Witnesses: E. J. Graham, E. N. Eaton and J. M. Bohrer.

State of Minnesota vs. Herman Trentel, in district court of Ramsey Co., Minn. Warrant sworn out by J. M. Bohrer September 26, 1893; indictment found by grand jury; case came before the October term of the district court; defendant appeared and plead guilty of having sold watered milk; fined $20.00 and costs. Witnesses: E. J. Graham, E. N. Eaton and J. M. Bohrer.

OLEOMARGARINE.

At no time in the history of this state have the manufacturers of oleo, made such determined efforts to establish a headquarters for their product in the large cities of the state as at the present time. Their determination in this direction is certainly worthy of a far better cause, and at no time have they met with such stubborn resistance, and with so many setbacks, at the hands of the dairy and food department. For some time past the manufacturers have been satisfied with having Duluth as their headquarters or distributing point, and as long as they confined their sales to the original packages in the hands of the importer's agents, the department under existing national laws, did not feel warranted in interfering with their business. This course seemed to embolden them, possibly imbuing them with the idea that the laws were all favorable to them, and that we were afraid to act in the matter. But as time went on, they sought for other fields to conquer and had the audacity and downright effrontery of their class, to seek to capture both

Minneapolis and St. Paul, directly under the nose of this department, as a base of operations, these cities being central, offered inducements that Duluth did not possess.

When the inter-state commerce law went into effect, oleomargarine was packed in tubs of from forty to sixty pounds each, and according to the rulings of the inter-state commerce commission, it could not be seized while in the hands of the agents of the manufacturers while the original package was unbroken, but that as soon as it was broken or was sold or transferred to third party, it immediately entered into the commerce of the state and became liable to seizure and to the laws of the state. It soon became apparent to the manufacturers that the large size of their packages seriously affected their sale, knowing full well that the stuff could not be retailed, and that dealers only, could handle such large packages. So, in order to evade the law, they have since shipped it in packages containing from ten to sixty pounds and delivering it directly to the consumers in such quantities as is desired. It has heretofore been shipped in packages that were sewed up in burlaps, but this method has been abandoned and the smaller packages adopted; the tubs used are as near in imitation of the ordinary butter tubs as they can be made and many of them are branded "Kansas Dairy" and "Kansas Creamery," etc., and in every instance are placed upon the market in as close imitation of the product of the creamery as it is possible to get it. Were it not for the "original package" clause of the inter-state commerce law, it would be much easier to get evidence that would materially assist in obtaining convictions in our courts. However, all the cases we have now on our hands, are those wherein the parties have violated the state or the inter-state laws. They evidently felt that as their position as agents were impregnable, they would go a step farther, but in so doing they made their mistake and the courts will decide the matter.

These methods of placing it on the market have seriously hampered the department in its work, and while our laws give us jurisdiction over stores, hotels, boarding houses, etc., we have no right to enter the sacred precincts of a private home and make seizures. When our inspectors commenced their raids the past fall, they found a very unsatisfactory state of affairs. It seemed as if many of the boarding houses, restaurants and some of the hotels had all at once decided to substitute "bull butter" for the genuine article. The work of seizure commenced at once both in St. Paul and Minneapolis. The result was that the department was the richer by several tons of "soap grease" than at the start. The raid was also taken up at Duluth and a rich haul was made there. Some of the parties plead guilty and paid their fines, others, to avoid notoriety, relinquished all claims to what was captured and about a dozen have concluded to let their cases go to the courts for settlement, which cases are now pending. In all cases, the attorneys for the packing houses appear in defence of the law breakers.

The parties whose cases are now pending are not all charged with the same offense. The charges are the violation of the pink law, requiring all oleo to be colored a bright pink, the selling it at retail, and the finding of broken packages in the hands of retailers and also selling it for pure butter.

The department has followed up these seizures with such persistency that the oleo business has greatly suffered by it, and the agents began to devise means to try and prevent us from performing our duty in the matter, and as a last resort, one W. M. Montgomery, an agent of Armour Packing Co. at St. Paul, made the following affidavit in order to procure an injunction restraining us from seizing any more of their goods. This affidavit will give the people generally, an idea of the virtuous character of these oleo people, and how much they have suffered at the hands of the farmers; they actually pose as benefactors. Here is the affidavit:

UNITED STATES CIRCUIT COURT, EIGHTH CIRCUIT. DISTRICT COURT OF MINNESOTA, THIRD DIVISION.

Armour Packing Co., Complainant, against Berndt Anderson, Defendant.

STATE OF MINNESOTA, } ss:
County of Ramsey. }

W. M. Montgomery, being first duly sworn, deposes and says, that he is the agent of the complainant, Armour Packing Co., and has been and is in charge of the agency and place of business of the complainant, at St. Paul, Minnesota, and of the sales of oleomargarine made by the complainant, at said agency, for four years last past. That for more than six years last past this affiant has been engaged in and acquainted with the manufacture and sale of the commercial article known as oleomargarine. * * * That the principal ingredients are neutral lard, oleo oil and butter. That coloring matter is also used in its manufacture, which coloring matter is a harmless substance manufactured from a seed known as annatto, and is the same substance which is universally used by the manufacturers of butter in coloring the butter made by them, and is the same substance which produces the yellow color in yellow butter at most seasons of the year. That in order to make the compound merchantable, and to insure its remaining sweet and salable, it is absolutely necessary that the ingredients used in its manufacture should be the best of their different kinds, and pure and sweet, and that the process of manufacture would be conducted in a cleanly manner.

That the ingredients used are pure, sweet, wholesome and nutritious, and that the process of its manufacture is conducted in a cleanly and wholesome manner, and that the product itself is wholesome, nutritious and in every respect fit for human food.

For six years last past this affiant has been acquainted with the substance which has been manufactured and dealt in in the United States, and shipped to and sold in all the different parts of the country under the name of oleomargarine, and that the article known by that name, whereever manufactured, shipped or dealt in, has been and is substantially the same thing; that it is of a yellow color, closely resembling yellow butter in its color, texture and taste, and he has never known of any article being manufactured or sold under the name of oleomargarine which did not closely resemble butter in all the respects above stated, and it is impossible to manufacture oleomargarine in such a way that it shall not look like butter to a greater or less degree, depending upon the proportions of butter and oleo oil used in its composition, and that oleo oil closely resembles in color butter in which no coloring matter has been used, and varies in color with the different seasons of the year precisely as the color of butter varies, being a light yellow in winter and a dark yellow in summer, * * * and the same is the oleomargarine of commerce, and is of the color of the oleomargarine of commerce, and is pure, sweet, wholesome and nutritious, and in every way fit for human food, and is in no way deleterious to the public health.

That in the state of Minnesota the sales of oleomargarine have been large for several years, but the demand for the same as an article of food has greatly increased during the past few months for the reason that a large portion of the population of the state has learned that it is superior to most of the butter in the market, and that they can procure the same at a less price than is ordinarily asked for butter, and they have gladly bought and used the same as a substitute for butter.

That oleomargarine is a patented article of commerce, and it has always commercially been made with an artificially yellow color as patented.

That annato and cotton seed oil are, and have been used by the manufacturers of oleomargarine to color the same, and it is this coloring preparation that gives it its fine yellow color.

The same substance is now used by the manufacturers of butter, to color their butter, but the manufacturers of oleomargarine used this color preparation for coloring their oleomargarine long before the manufacturers of butter used the same for coloring butter.

That this affiant has been for several years last past acquainted with the manufacture of butter, and the process of its manufacture, and the preparation used to color the same, and to-day nearly all the butter sold in the markets of the state of Minnesota, is artificially colored with annatto and cotton seed oil, and for several years last past, the butter sold in the markets and stores of Minnesota has been colored in imitation of oleomargarine made by the complainant and by all the leading manufacturers thereof. * * * The complainant has never sold, or offered for sale, and it does not propose hereafter to sell or offer for sale, oleomargarine for butter, or as butter, and that it has always sold and offered to sell, its said oleomargarine at its said agencies in Minnesota, as and for an article of commerce, and as and for an article of food, and the same has always been bought by the purchaser thereof as and for oleomargarine, and not as and for butter. * * *

And this affiant further says, that on the 20th day or November, A. D. 1893, he went to the office of the defendant, to see him and ascertain what he proposed to do about the oleomargarine and business of the complainant at its agencies in the state of Minnesota, and he informed him that the complainant had on hand at its agencies a large amount of oleomargarine in the original unbroken packages, in which it had been packed and shipped by it from Kansas City to St. Paul and Duluth for sale in such packages for human food, and this affiant desired to know whether the defendant proposed to seize and confiscate the same, and to break up and destroy the business of the complainant at its said agencies in Minnesota, and the defendant told this affiant that he did, and that he would seize and take possession of said oleomargarine, and of all the oleomargarine he could find in the state of Minnesota, whether it was in the original unbroken packages or not, and whether it was in the possession of the complainant or its agents or not, and he would continue to seize and take possession of any oleomargarine the complainant shipped into the state of Minnesota for sale, or offered for sale in the original packages, and would continue to do so until he had broken up and destroyed the sale of oleomargarine in any form or packages, or under any circumstances whatever by the complainant or any other party or person, provided said oleomargarine was not colored a bright pink.

And this affiant further says, that to color oleomargarine any other color than yellow would utterly destroy its commercial character and destroy its value and its sale.

That the yellow color of the oleomargarine of commerce is as much a part of said commercial article known as oleomargarine, as is any other characteristic or ingredient thereof, and much more so.

The above are such portions of the affidavit of W. M. Montgomery (Armour's agent) as is of interest to the department and dairy men throughout the state, and is a series of misstatements throughout, made for the purpose of enjoining us from interfering with their sales. The application for an injunction was made to Judge Nelson, of the United States circuit court, entirely without our knowledge and a temporary injunction granted, to-wit:

UNITED STATES CIRCUIT COURT, EIGHTH CIRCUIT. DISTRICT OF MINNESOTA, THIRD DIVISION.

Armour Packing Co., Complainant, against Berndt Anderson, Defendant.

An application for a writ of preliminary injunction having been made by the complainant in the action above entitled, and the hearing of the motion therefore fixed for the 9th day of January, A. D., 1894, and it having been made to appear that there is danger of irreparable injury being caused to the complainant before the hearing of said application for said writ of injunction, unless the defendant is, pending such hearing, restrained as herein after set forth, and the complainant having filed herein a bond in the penal sum of one thousand dollars for making good to the defendant the damages and costs that may be awarded it by reason of such injunction.

Now, on motion of Edward P. Sanborn, Esq., the complainant's counsel,

It is ordered, That the defendant, Berndt Anderson, his servants, agents, deputies and employes, be and he, and each of them, are hereby specially restrained from seizing or taking possession of any of the stock of oleomargarine in the bill of complaint referred to, belonging to the complainant in the state of Minnesota, and from seizing or taking possession of any of the oleomargarine of the complainant, which it may hereafter ship into the state of Minnesota, while in its possession, or in the possession of the agents of the complainant in the original unbroken packages in which it is shipped by the complainant into the state of Minnesota, from the place of its manufacture by the complainant outside of said state, and from in any way interfering with the business of the complainant, in the bill of complaint referred to, in the state of Minnesota, or with the sale or the delivery by the complainant of its oleomargarine to the purchasers thereof in said state in the original unbroken commercial packages, in which the same is shipped into the state of Minnesota by the complainant, until the hearing upon said application for a writ of injunction, and the further order of the court in the premises.

(Signed) R. R. NELSON,
Judge.

Dated Nov. 22, A. D., 1893.

It is certainly news to the dairymen and others of this state, to learn from this affiant that butter is made in imitation of oleomargarine, as it has always been supposed that the opposite was the case, but when this statement comes from so high an authority as an agent of a packing house, we have no other resource than to accept it as a fact.

In his statement regarding the composition of oleo, he says it is composed of neutral lard (probably meant entrail lard) oleo oil and butter. He did not occupy any time telling the court that a great portion of the oleo oil was obtained from city rendering establishments, where horses and other animals are reduced to oil. He would rather not have his patrons know anything about these things.

Regarding the color which he states to be annatto, we have this to say, that we have analyzed a great many samples of Armours and other brands of oleomargarine, and we have yet to discover the first sample colored with annatto, the coloring matter that they have used has been found to be methyl orange, which is made from aniline so commonly used as a dye. He also states that for the past few months, the sales of oleomargarine has greatly increased, owing to its superiority over butter. This must certainly be cheering news to the dairymen of the state, who pride themselves on the high standard of their product. If such is the case, I ask, why do the manufacturers of oleo brand their stuff "Kansas Dairy," "Kansas Creamery," if such is the case; this action on their part gives the lie to the whole matter. They even procure the same tubs used by dairymen, in which to pack and ship their oleo. Their intention and aim is to make it appear as near like butter as possible, and their whole business is one of fraud and deception.

The law passed in this state in 1890, compelling oleo to be colored a bright pink, is seriously objected to by these people, This law is the same as the New Hampshire law, and has been held constitutional, and a case of the same kind has gone to our supreme court recently, which was also held to be constitutional.

In the matter of Fred Weideman vs. State of Minnesota, the State Supreme Court rendered the following decision:

State of Minnesota, Supreme Court, Oct. Term, A. D. 1893, No. 166.
In the matter of Fred Weideman on Habeas Corpus, Fred Weideman, Respondent vs. State of Minnesota, Appellant.

1. The provisions of Gen. Laws, 1891, Ch. 11, "an Act relating to the sale of imitation butter" are valid as a legitimate exercise of the police powers of the state.

2. The offense prohibited in Sec. 1 of said Ch. 11, is a misdemeanor and the penalty therein specified is to be recovered in accordance with the provisions of G. S. 1878, Ch. 78, Sec. 10, by a criminal prosecution in a court of competent jurisdiction.

The above Ch. 11, Gen. Laws of 1891, is the pink law referred to and its constitutionality being upheld by the supreme court of the state has placed a very effective weapon in the hands of the Dairy and Food Department, and has created consternation in the ranks of the manufacturers of slaughter house butter.

This department denies emphatically that any of its members ever told Mr. Montgomery that it would seize all oleo that came into the state regardless as to whether it was in the original packages or whether in the hands of the agents or not. The department has had able counsel and is fully aware of its jurisdiction in the matter, and has studiously avoided interfering with oleo in the hands of the agents, but as soon as it left the hands of the agents and entered into the commerce of the state, we hold that we have the power to seize and confiscate the same whether in the original package or not, which course we have pursued and will continue to pursue until compelled by law to desist. The oleo people claim that if compelled to color their product pink, that it will virtually kill their trade. They certainly could not expect us to aid in passing laws beneficial to them, and we sincerely trust that their views in the matter are the correct ones. But we have this to say, that if oleomargarine possesses all the virtues they claim for it and is so superior to butter, why cannot the public educate themselves to like a pink color as well as yellow, as persons must educate themselves in order to relish oleo. "A rose by any other name would smell as sweet," the same rule holds good with oleomargarine. I desire at this time to express my high appreciation of the untiring efforts of the inspectors of my department, every member of which is in hearty accord and sympathy of the laws of the state, and if the unholy traffic is not suppressed it will not be on account of their lack of vigilance.

The state of Minnesota will ere long cease to be one of the wheat raising states of the union, owing to the unsatisfactory returns from the wheat fields. It will naturally gravitate to that of diversified farming, which is the true solution of our agricultural problem; in that case dairying and stock raising will be the leading features. No state in the union is more blessed with all the natural advantages for this line of industry as to pure air, clear and sparkling water, and rich, nutritious wild grasses, than is the North Star state. It therefore becomes incumbent on every citizen of the state, who has its welfare and material interests at heart, to unite and overthrow this giant octopus that is trying to fasten its deathly tentacles upon us and prevent us from becoming what God destined us to be "the leading dairy state of the Union."

You will notice by perusing the large number of seizures made as hereinafter specified, that the same has been placed in cold storage. This is a course we have invariably pursued where the seizures have been made in hotels, restaurants and boarding houses, etc., and after waiting a sufficient time for the parties to replevin the same and they fail or refuse to avail themselves of the opportunity, we then apply to the court for an order to sell the same at public sale, for other purposes than for food, and the money so received is placed in the state treasury to the credit of the dairy and food commissioners' fund. Usually the matter in such cases ends there, as the parties are visited by our inspectors at frequent intervals afterwards, but it is seldom that a second seizure is necessary. Some of the parties who were in possession of a large supply at the time the seizures were made, caused the same to be replevined, and those cases are now pending. But in all cases where we find oleo has been placed on sale as butter or where it is sold at retail or the broken package, we have commenced proceedings at once. A number of such cases are now pending, and we have reason to believe that when these cases have been fairly tried, our laws will be fully sustained, and oleo can only be sold under the provisions of the inter state commerce law, at least so far as this state is concerned.

OLEOMARGARINE CASES.

State of Minnesota vs. Frank Cox. In municipal court at Duluth, before Judge Powell. Warrant issued May 23, 1893; charged with the sale of oleomargarine for butter. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer. Bound over to the grand jury and indictment found; case pending before the district court at Duluth.

State of Minnesota vs. Mosher & Knittle. In municipal court at Duluth, before Judge Powell. Warrant issued May 23, 1893; defendants charged with having sold oleomargarine not colored pink as required by law. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer. Defendant appeared May 31, plead guilty and was fined $50 and costs.

State of Minnesota vs. P. M. Garigon. In municipal court at Duluth, before Judge Powell. Warrant issued May 23, 1893; defendant charged with having sold oleomargarine not colored pink as required by law; taken from municipal court under habeas corpus proceedings to circuit court May 31, 1893, and there thrown out on grounds of not being a criminal case; appeal was taken to October term of supreme court and order reversed; case now pending before district court at Duluth. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. Fred Weideman. In municipal court, Duluth, before Judge Powell. Warrant issued May 23, 1893; same charge as above. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer; same disposition as above case, still pending before circuit court at Duluth.

State of Minnesota vs. Emile Constant. Warrant issued June, 1893; case tried in municipal court, St. Paul, before Judge Twohy, July 3, 1893; defendant charged with using oleomargarine at his hotel, not colored pink as required by law; case dismissed on account of illegality of warrant. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. N. Y Restaurant. In municipal court, St. Paul, before Judge Twohy; warrant issued July 3, 1893; defendant charged same as above case. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer. Case dismissed on account of illegality of warrant.

State of Minnesota vs. Walter J. Mears. Warrant issued July 7, 1893; in municipal court, Minneapolis; defendant charged with selling oleomargarine as butter; defendant appeared and was bound over to the grand jury of Hennepin county. Witnesses, H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer. Defendant since deceased, case dropped.

State of Minnesota vs. Owen Epply. In municipal court, Minneapolis, before Judge Mahoney; warrant issued July 7, 1893; sold oleomargarine as butter. Witnesses, H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer. Bound over to the grand jury, case pending.

State of Minnesota vs. W. W. Sewerly, in municipal court, Minneapolis. Warrant issued July 7, 1893; sold oleomargarine as butter; bound to the grand jury; case pending.

State of Minnesota vs. C. C. Mullen. In municipal court, Minneapolis; sold oleo as butter; warrant issued Sept. 20, '93. Witnesses, H. A. Hokemeir, E. N. Eaton, chemist, and J. M. Bohrer. Bound to grand jury; indictment found; case pending.

State of Minnesota vs. John Nelson, in municipal court, Minneapolis. Warrant issued September 20, 1893. Defendant sold oleomargarine as butter; bound to grand jury and indictment found; case pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. C. Connolly, in municipal court, Minneapolis. Warrant issued September 20, 1893. Sold oleomargarine as butter; bound over to grand jury and indictment found; case still pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. J. N. Davis, in municipal court, Minneapolis, Warrant issued September 20, 1893. Sold oleomargarine as butter; bound to the grand jury and indictment found; case still pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. Chas. Watson, in municipal court, Minneapolis. Warrant issued September 20, 1893. Sold oleomargarine as butter; bound to the grand jury and indictment found; case still pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

OLEO SEIZURES.

From J. P. Mattson, Minnesota and 5th street, St. Paul; seized by J. M. Bohrer and E. B. Williams, 1 package of rolls, marked "Kansas Dairy," in cold storage.

From Champion restaurant, 347 Minnesota St., St. Paul, 1 broken package, seized by Bohrer and Williams, placed in cold storage; "Kansas Dairy."

From A. Charboneau, corner Wabasha and 7th St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From American House, corner Wabasha and 4th St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams; placed in cold storage.

From Dominick Spillman, 354 Minnesota St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From M. Y. Bridges, 414 Jackson St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From T. Asbjornson, 200 2d St. S., Minneapolis; 1 broken package, seized by Bohrer and Williams; placed in cold storage.

From Henry Schmidt, corner 6th St. and Washington Ave., Minneapolis; three packages seized by Hokemeier and Wildt, and placed in cold storage.

From Willard M. Severy, 28 1st Ave. N., Minneapolis; two packages seized by Hokemeier and Wildt; placed in cold storage.

From John G. Swanson, 101 2d St. S., Minneapolis; seized two packages by Hokemeier and Wildt; placed in cold storage.

From P. G. Nelson, 129 2d St., N. Minneapolis; one package seized by Hokemeier and Wildt, and placed in cold storage.

From Joseph Herrman, 415 Rosabel St., St. Paul; 1 package seized by Hokemeier and Bohrer; placed in cold storage.

From J. G. Brandtberg, 223 E. 6th St., St. Paul; 1 package seized by Bohrer and Hokemeier; placed in cold storage.

From Emile Constant, 260 E. 6th St., St. Paul; 1 package seized by Bohrer and Hokemeier; placed in cold storage.

From Mrs. Kraemer, No. 1600 2d St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. J. Fritz, "Union House," Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. McNally, 1613 2d St. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Martin Matson, 1818 Washington Ave. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Washington House," 214 Washington Ave., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From James McMakin, 206 Washington Ave., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Ames House," Camden Place, Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Eric Olson, 2329 2d St. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From A. Schrover, 317 Washington Ave. N., Minneapolis; 1 package seized by Davis and Bohrer and placed on cold storage.

From M. Weir, 1320 Washington Ave. N., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From City Lunch Room, 108 Washington Ave. S., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From John Clemon, 47 3d St. S., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From Richelieu House, 241 1st St. S., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From Mrs. Carlson, 815 3d St. S., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From Mrs. Jersdt, 249 Cedar St., Minneapolis; 1 package seized by Bohrer and Williams and placed in cold storage.

From W. Anderson, 259 Cedar St., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From "Parker House," 13½ 4th St. S., Minneapolis; 1 package, seized by Bohrer and Davis, and placed in cold storage.

From Mrs. Peter Olson, 216 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Grand Central Hotel," 1st St., Minneapolis; 2 jars seized by Bohrer and Davis, and same placed in cold storage.

From "Scandia House," 125 2d St. N., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "Skandia House," 200 2d St. S., Minneapolis; 2 packages seized by Bohrer and Davis, and same placed in cold storage.

From "Norman House," 223 2d St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From Matt Meyer, 30 1st St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From H. Bussi, 16 1st St. S., Minneapolis; 1 package, seized by Bohrer Davis, and same placed in cold storage.

From "Brigham House," Minneapolis; 1 package, seized by Bohrer and Davis, and same placed in cold storage

From "6th Ave. Hotel," 6th St. and Washington Ave., Minneapolis; 1 package, seized by Bohrer and Davis, and same placed in cold storage.

From "Foster House," 28 7th Ave. N., Minneapolis; 1 package seized by Bohrer and Davis and same placed in cold storage.

From "Brittania House," 213 1st St. N., Minneapolis; 2 packages seized by Bohrer and Davis and placed in cold storage.

From Eliza Collins, 31 Central Ave., Minneapolis; 1 jar seized by Bohrer and Davis and placed in cold storage.

From "Clifton House," 20 3d St. Minneapolis; 1 package seized by Bohrer and Davis and same placed in cold storage.

From Mrs. Littlefield, 422 Central Ave., Minneapolis; 1 package seized by Bohrer and Davis and same placed in cold storage.

From "1st Ave. Hotel," 1st Ave. N. E. and 5th St., Minneapolis; 1 package seized by Bohrer and Davis and same placed in cold storage.

From Mrs. J. A. Miles, 209 4th St. N., Minneapolis; 1 package seized by Bohrer and Davis and same placed in cold storage.

From "Progress" restaurant, 8 Washington Ave., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From Mrs. C. F. Munger, 129 7th St. N., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From Gabriel Johnson, 1601 5th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "New Court House Restaurant," 310 4th St. S., Minneapolis; 1 jar seized by Bohrer and Davis, and same placed in cold storage.

From Mrs. Elsie Castofan, 1003 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and the same placed in cold storage.

From Andrew Heogh, 1325 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "Rising Sun Hotel," 373 Rosabel St., St. Paul; 1 package seized by Bohrer and Hokemeier, and placed in cold storage.

From John P. Mattson, cor. 4th and Rosabel St., St. Paul; 1 package seized by Bohrer and Hokemeier, and placed in cold storage, 2d seizure.

From Kimbal & Hughes, 3d and Nicollet, Minneapolis; 1 package seized by Bohrer & Hokemeier, and placed in cold storage.

From Mrs. Goudy, 700 Hennepin Ave., Minneapolis; 1 package seized by Bohrer and Hokemeier, and placed in cold storage.

From "Metropolitan Hotel," 628 Hennepin Ave , Minneapolis; 1 package seized by Bohrer & Hokemeier, and same placed in cold storage.

From Matt. L. Chartier. delivery wagon, Minneapolis; 13 packages seized by P. W. Wildt, inspector, and same placed in cold storage.

From "Railroad Eating House," Austin, Minnesota; 2 packages seized by E. J. Graham, assistant commissioner, and same placed in cold storage.

From J. H. Cole, Carleton, Minnesota; 1 package seized by E. J. Graham and H. A. Hokemeier, and same placed in cold storage.

From J. Wilky, Duluth, Minnesota; 36 packages seized by E. J. Graham and H. A. Hokemeier. The same was replevined by Wilkey, case still unsettled.

From Simon Clark, Grocery Co., Duluth, Minn.; 4 packages seized by E. J. Graham and H. A. Hokemeier, and same placed in cold storage.

From R. McCue, West Duluth, Minn.; 1 package seized by E. J. Graham and H. A. Hokemeier, and same placed in cold storage.

From St. Charles Hotel, West Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From M. Brown, 2d St., West Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From O. Olson, Skandinavian Hotel, West Dulut;h 1 package seized by Graham and Hokemeier and same placed in cold storage.

From Jos. Blake, West Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From M. Mathieson, 1st St. and 9th Ave., West Duluth; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From James Connors, West Duluth, Minn.; 1 packages seized by Graham and Hokemeier, and placed in cold storage.

From Gus Runquist, West Duluth; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From Winona House, Winona, Minn.; bought 3 pounds as and for butter; case to be prosecuted; Graham and Hokemeier.

From Merchants Hotel, Winona, Minn.; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From Sherwood House, Winona, Minn.; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From J. W. Cumming, Duluth, Minn.; 1 package seized by Graham and Hokemeier and same placed in cold storage.

From A. Lemay, Duluth, Minn.; 1 package seized by Graham and Hokemeier and same placed in cold storage.

From John Holberg, Duluth, Minn.; 1 package seized by Graham and Hokemeier and placed in cold storage.

From A. Meyer, Duluth, Minn.; 1 package seized by Graham and Hokemeier and same placed in cold storage.

From S. H. Reed, Duluth, Minn.; 1 package seized by Graham and Hokemeier and placed in cold storage.

From Matt Meyer, 30 1st St. S., Minneapolis; 1 package seized by Hokemeier and Davis and same placed in cold storage.

From Minneapolis Provision Co., Minneapolis; seized 273 packages, by Hokemeier and Davis; this was replevined by the Minneapolis Provision Co. November 4, 1893, and delivered to them by the sheriff; case to be tried January term of Hennepin county district court.

LARD.

The present condition of the lard market is not strictly in harmony with the wishes of this department. The law as it now stands, allows "Lard Compound or Lard Substitute" (a combination of stearine, cottonseed oil, etc.) to be sold on the markets of the state under certain conditions, viz: "That each package shall have firmly affixed upon it, a label upon which is printed in letters of not less than one-half inch high, the words "Lard Compound" or "Adulterated Lard" and immediately following the same, in letters not smaller than long primer, the name and approximate proportions of the several constituents contained in the mixture or compound, and shall furnish the purchaser at the time of sale, a card upon which is legibly printed, the name of the article as hereinbefore defined, and a list of the several component parts of the mixture, provided the conditions above stated are complied with, this article becomes recognized upon our markets as a legitimate product and will contest the field for a portion of the traffic that has been in the control of pure lard, and there is no article placed upon the market, however unhealthy or impure, but what will find a sale however limited that sale might be, but it is a fact beyond denial, that every pound of this compound sold, displaces just so much of the pure article, and the producer of pure foods has just one more enemy in the field with which to contend.

The conditions governing the lard market have materially changed within the past few years, especially is this the case regarding the source from which our merchants receive their supply. In former years the farmers of the state sold their pork dressed, and the farmers and local butchers rendered the lard and placed it upon the market strictly pure, but since the advent of the great slaughtering establishments of Chicago, Kansas City and other large cities, the bulk of the lard placed upon the market comes from these establishments. The farmers have now ceased slaughtering and have adopted the plan of shipping their hogs on foot, that source of supply has, therefore, been cut off and the consumer must rely mainly on the product of these establishments to furnish this necessary article.

It is not to be wondered at that substitutes are fast displacing the lard of commerce on our markets; the blame can justly be laid at the doors of the packing houses. It is only necessary to pay a visit to these rendering establishments, and see the reeking mass of filth from which "pure lard," "kettle rendered lard," "steam refined lard," etc., and the many other high sounding brands, are extracted from, the sight would forever wean a person from a desire to use lard in the preparation of food, even though it were ever so pure; these facts having been brought to the notice of the public, it is but natural that a substitute should be sought for.

At the last session of the Minnesota legislature, an amendment to our present lard law was passed, whereby "cottolene" was excepted from the penalties provided for the sale of imitation lard. Cottolene is a combination of refined cotton-seed oil (a purely vegetable product) and selected beef suet, and is claimed by chemists and others to be perfectly healthy; however this may be, it is certainly preferable in view of its cleanliness, and it has become a recognized commodity on the markets of our state in the eyes of the law, and from our observation seems to be growing in favor. While this department is not recommending this product to the public, yet we are not in a position to condemn it without a more thorough investigation, and the production of more substantial proof than has yet been brought against it. It is an undeniable fact that many housewives of this country through prejudice, or a long continued use of lard cannot see any virtues in a substitute. This is but natural, and even though the lard of the present day contained no adulteration, the filthy manner in which it is produced has conspired to bring about the present condition of affairs. It is certainly a deplorable condition of circumstances, when a state of the importance of Minnesota, that raises many hundreds of thousands of hogs annually, that are shipped to markets outside of our state, and substitutes for lard are sent back for our use, thereby displacing a large amount of the genuine article, depriving consumers of the privilege of the use of an article of known purity and healthfulness, and one of the staples of our own production. It has been stated that the packing and slaughtering establishments utilize every portion of the hog with the bare exception of the squeal, and they are at present busy trying to find a use to which that may be put, that nothing may escape.

The time is certainly coming when it will be necessary for the general government to enact laws governing the adulteration of foods, and until such time arrives, the dairy and food departments of the various states will meet with more or less opposition in the enforcement of their local laws. The interstate commerce law has thus far proved a curse rather than a benefit to the farmer and dairyman, and will continue to be a menace until certain amendments are made to it, which it is sincerely to be hoped will occur soon.

BAKING POWDERS.

The baking powder market of this state was never in as good condition as at present. The law compelling all alum powders to be branded, "this baking powder contains alum," is very generally complied with and, it is only in isolated cases that the law is violated, and when such cases are detected and the attention of the merchant in whose possession it is found, is called to the fact, he either removes it from his shelves or causes the necessary label to be affixed. The merchants of our state are very desirous of placing none but pure goods on sale, and heartily co-operate with this department in their efforts to that end. For years past and until the dairy and food laws were enacted, the baking powder business offered a very lucrative field for those desiring to embark in a business that offered great returns for a small outlay; during those times the very cheapest alum and ammonia powders came into competition with the highest grade of cream of tartar powders. The cream of tartar powders had to be sold at a very close margin and often at a loss, while the common powders brought four times their actual worth, regardless of their unhealthy character. Heretofore, any article placed upon the market and labeled "baking powder" was bought by the consumer, without questioning the healthfulness or genuineness of the article, nor can this be wondered at, owing to the fact that the consumer never gave a thought regarding its component ingredients, so long as it performed its functions, nor was the attention of the general public attracted in this direction until after the food laws were enacted, and the investigations of eminent chemists made public. Then and not until then, did the consumer awaken to the true condition of things. Honest powders do not now come in competition with these cheap frauds. The law does not seek to drive the cheap powders from the markets, but only to compel these goods to be sold on their merits and for what they actually are, thereby allowing people, if they desire a cheap article, that privilege without being deceived.

This department has been annoyed on various occasions by the means resorted to by a certain baking powder firm (The Royal), in which through the medium of glaring advertisements that have appeared in most of the papers throughout the land, sought to convey the idea by implication to the public, that the Minnesota State Dairy and Food Department, had endorsed said Royal baking powder as the best powder made. We have repeatedly written to that firm and its agents, and also to the several newspapers in St. Paul and Minneapolis, forbidding each and all of them from using the name of the department in any of their testimonials, but without replying to us have persisted in so doing. It is a part of the policy of this department, to refuse the use of its name in the endorsement of any article of food within its jurisdiction. We will furnish parties a full analysis of any sample brought to us, and they may use such report as they see fit, but the consumer must draw his conclusions by comparison with that of other samples, and then we only vouch for the sample, and not for the commodity which that sample represents. We wish to say at this time that this department never said, or led the "Royal" people to believe that their powder was the best in the market. Our analysis of their goods would not bear out any such statement. It is not our desire to make war on said firm, or to try to injure their business in any way, but to warn the public that in all cases where the name of the Minnesota State Dairy and Food department is used as an endorser of the quality of said goods, or their superiority over others of the same class, that it is unauthorized and fraudulent. We have this to say regarding pure baking powders, that in our research among the baking powders on sale, that the purest and best powders found upon our markets are made in the state of Minnesota, and it gives the department great pleasure to be able to make this statement, and our loyalty to the state of Minnesota and her young and growing industries should impel us to encourage the same. Nor is this the only reason, but also that if the goods are not found to be as represented, the party placing the same on the market is within reach of the strong arm of the law, and the purchaser has means of redress, which would be denied him if purchased from parties outside of the state.

VINEGAR.

Regarding the condition of the vinegar market, I will merely refer the reader to the report of the department chemist, that will appear later on. While our inspectors find occasional samples that are illegal on the markets, yet the supply is very good in quality. Some of the vinegars are slightly deficient in either acidity or solids, but their general character is what they purport to be, as designated by their brands. The "Alden" vinegar, celebrated for its spurious and illegal character, still leads the procession in that line as you will see by consulting the chemist table, but we are happy to state that very little is sold in our markets at the present time as the merchants of the state are "on to them," so to speak.

There are other vinegars which we would warn the merchants from buying until they have sent a sample of (4 ounces,) the same to this department for analysis, which will be given free of cost to any one in the state, viz.: Red wine vinegar, Amber vinegar, Malt vinegar, etc The Red wine and Amber vinegars have been proven to be a low wine colored vinegar, and illegal on our markets. Some of the malt vinegars, placed upon our markets are White wine vinegars colored and malt extract added. This does not fulfill the requirements of the law, as a malt vinegar must be made direct from the malt, and the department will condemn any it may find that is not so made. The firm making the vinegar in which the extract has been used, has been notified that it is illegal, and must therefore find no fault when summary action is taken.

A case of poisoning at Excelsior last summer, where a number of persons were seriously poisoned, caused considerable excitement at that time, but fortunately no fatalities occured. The cause of the unfortunate affair was traced to some vinegar sold at a certain store, and all who used of this vinegar were seriously affected. The vinegar in question was from a barrel manufactured by the Northwestern Vinegar Works of St. Paul, and sold a merchant at Excelsior. After the news of the poisoning reached the ears of this department, inspectors were immediately dispatched to Excelsior and samples taken from the vinegar yet in the hands of the parties where the poisoning occurred, and also from the barrel in possession of the merchant from whom it was obtained, and in every case large quantities of arsenic were found. We also procured some of the heavy sediment from the bottom of the barrel, and found it to be composed almost entirely of the arsenic of commerce. The department then made a thorough investigation of the vinegar on hand at the factory of the Northwestern Co., and also where ever the same was found on sale, and in every instance found it to be a legal vinegar, fully up to the requirements of the law, and free from any ingredients detrimental to the public health. How this particular barrel happened to contain such an amount of poison cannot be accounted for either by the manufacturer or the merchant who sold it, unless it was done by an enemy of either one or the other to accomplish revenge for some fancied wrong, but the department, after a thorough investigation, feels that no portion of the blame rests upon the manufacturer or seller, as they were as desirous of detecting the guilty party as were we. The amount of arsenic found in the bottom of the barrel and in solution, was estimated at about two pounds, enough to have depopulated the entire village, and it really seems an interposition of providence, that no fatalities occurred.

Herewith I submit a report of the work done in the laboratory of the dairy and food department in the charge of the department chemist, E. N. Eaton, M. Sc.

This report covers the work recorded by W. S. Eberman, chemist, in the St. Paul department, and Charles W. Drew, Ph. B., in the Minneapolis department, from Aug. 1, 1892, to Feb. 1, 1893, and my own work from March 1, 1893, to Nov. 1, 1893.

In all work reported I have given the name of the analyst responsible for the analysis. In case an analysis was found in the record book and no reference given, I have drawn such conclusion as the data would in my judgment warrant. In the main the analysis is recorded only of such samples of food as were found to be illegal or adulterated. An exception is made in the report on cheese, the reason for which will be made manifest when reading the report on that subject.

The means employed in the adulteration of the various articles or food change from year to year. Those used in our state since I have been connected with the commission, will be found under the caption of the articles of food covered in this report. Below is shown the number of samples analyzed or otherwise satsifactorily examined.

RESUME.

	Number analyzed.	Illegal or adulterated.
Milk	109	71
Cream	3	3
Butter	120	49
Cheese	444	4
Lard	156	15
Vinegar	560	85
Baking powder	21	8
Honey	1	1
Liquors	7	0
	1,421	236

MILK.

The average quality of milk sold in the state is encouraging. Not only has there been a decrease in adulteration, but the milk has run unusually high in those constituents that make it of value as a food. This increase in fat and solids may be due in part to the dry season, yet a prime cause is found in the comparatively high standard for milk enacted by the legislature of Minnesota and the rigid enforcement by the commission. Thus law acting through judicious breeding, feeding and keeping can, and does enhance the value of our food products.

At this time little will be said regarding the formation, composition and chemical analysis of milk. This has been well covered in the chemists' report of previous years. A few remarks may not be irrelevant upon some recent acquisition to our knowledge touching the dairy interest.

Citric acid has been found to be a constant ingredient of cows' milk. It is also found in considerable quantity in human milk, and the milk of mammalia in general. The acid of course, is not in the free state, but in the form of the calsium salt. It is estimated that in one gallon of cows' milk there is the equivalent of two lemons. According to Herz there is found in milk, butter and cheese, bodies which in size, form and chemical properties closely resemble starch, and which he calls "amyloid" bodies. "Whether or not these amyloid bodies always occur in milk, and whether they have any importance in connection with the manufacture of milk products, are questions for future study."

The last year has been especially prolific in literature pertaining to the effect of feed upon the yield and composition of milk.

From various authors and personal experience the following is summarized:

The fat of milk of individual cows with the same conditions varies from day to day. Weather has but little effect upon the quality and quantity of milk. A change from pasture to stable increases both quantity and quality, more noticeably the quantity. Breed and individual characteristics influence the composition of milk more than other factors, the Jersey usually giving the highest percentage of fat, and the Holstein, the lowest. On the other hand the Holstein gives a much larger quantity of milk than the Jersey on the same feed. It is well known that as the period of lactation advances, the yield of milk is less in quantity. It is equally patent that the quality is improved. This is plainly shown in an analysis of Jersey milk sampled from the last milking before going dry.

Total solids	28.43
Fat	14.67
Solids not fat	13.76

The *total* amount of fat produced decreases as the period of lactation increases. There can be no definite rule as to the relative richness of night and morning milk. Sometimes the morning milk will be the richer, and vice versa. It depends upon the time between milking, the season of the year, the exercise of the cow and the food. The last portion of the milking is much richer than the first. In fact, the "strippings" approach cream in composition, while the fore milk is nothing but skimmed milk, and is so regarded by the court. By milking often (three or four times a day) a larger, total of fat will be obtained, but it is doubtful if this gain would be a permanent one.

J. W. Robertson is authority for the following: "The teaching of experience points to the economy of providing for milch cows a ration of succulent quality. 2nd. Feeding as large a quantity of feed as the animal will eat up clean. 3rd. Making the ration of such a gross and bulky composition that not more than from six to eight pounds of meal—the concentrated and expensive part of feed—will be consumed by the ordinary cow per day. Corn silage is not in itself a complete or suitable food for milch cows."

Contrary to Robertson, the Vermont and Iowa experiment stations do not find that watery food makes watery milk. If the dishonest milkman relied on watering the cow and feeding succulent food to dilute the milk the public might rest secure in the enjoyment of wholesome milk without police supervision.

It has until lately been a disputed question whether feed had any marked influence upon the quality of milk, although all have admitted its influence upon quantity. Now it is generally conceded that food influences quality full as much as quantity of milk produced. The healthfulness, nervousness and general physiological condition of the cow; the milkman and his habits —even the environments of a cow affect the yield and composition of the milk.

The Babcock test marks a great epoch in the dairy industry. After years of labor on both sides of the Atlantic, it remained for a western man to develop a quick, practical and accurate test of the fat in milk, and in the West we have received the greatest development therefrom.

Cooke suggested the plan of paying for milk according to the fat content; Patrick conceived the composite sample and discovered a perfect preservative; Farrington and others have found that a preservative is unnecessary. Prof. Patrick recommended simply powdered corrosive sublimate (mercuric chloride) with enough "aniline rose pink" to color. The amount of powder that may be held on the point of the blade of a knife, .5 grams, is sufficient for one-half pint of milk. (I have seen fully one half teaspoonfull used for less than four ounces of milk.) As this preservative is a violent poison, numerous attempts have been made to find a substitute. Potassium bichromate (bichromate of potash) has perhaps proven most successful, but it is not yet fully recommended, and besides is patented. Sour and decomposed milk may be made in good mechanical condition by adding powdered dye.

Prof. Patrick has invented a very successful acid measure for the Babcock test. See bulletin in No. 19 Iowa experiment station, Ames, Iowa. Most of the larger creameries in the West and in the East have adopted the system of paying by the "test," and it would undoubtedly be more business-like if all should do so.

The adulteration of milk was found to be as in the past largely the abstraction of fat and addition of water. Whenever there is profit in being dishonest people will be found willing to take the chance of detection. Then there are a few who believe in being lawfully honest, and if their milk runs much higher in fat content than is required by law, will add enough water to reduce it to the standard of 3.50 per cent. fat. Others would not skim their milk by the usual methods but prefer to save the strippings. Aside from the willful adulteration, perhaps the more ignorant milkman unknowingly sells off the richer milk, as the cream rises to the top and gives the last patron the skim milk. This liability to separation of cream during delivery has, however, been overestimated, as experiments by the N. Y. Experimental station and an excellent German authority show that this will not happen with occasional stirring of the milk in the can and the agitation incident to traveling.

A total of 109 samples of milk have been analyzed, of which 71 were adulterated (skimmed or watered) or illegal. As only suspicious samples were delivered to the chemists these figures are no indication of the average quality of milk on the market. It may be stated that as the figures for fat were obtained by a modified Wanklin method (a few of my own by the Verner Smidt) they are probably a trifle low. In the table of analyses a skimmed milk means a milk deprived of a portion of its original fat.

MILK ANALYSIS.

W. S. EBERMAN, Chemist.

Name of Seller.	Location.	Solids.	Fat.	Solids, not fat	Ash	How adulterated
Fairpoint	Fairpoint	9.24	2.60	7.60	....	Skim.
McCrary Bros	Oronoco	10.60	3.00	7.60	....	Illegal.
Kenyon Creamery	Kenyon	9.30	0.10	9.20	....	Skim.
Crescent Cremery	Berge Corner	9.90	0.10	9.80	....	Skim.
John McCullum	Farmington	12.50	2.98	9.52	....	Illegal.
R. Wise	Brainerd	7.04	4.76	3.20	....	Watered cream.
F. R. Peck	St. Paul	7.40	2.00	5.40	....	Watered.
do.	do.	11.20	2.00	9.20	....	do.
do.	do.	10.90	3.70	7.20	....	do.
J. Daily	do.	7.96	4.76	3.20	....	Watered cream.
F. R. Peck	do.	6.40	0.60	5.80	....	do. & skimmed
G. Barrett	Brainerd	10.54	2.66	7.88	....	Illegal.
do.	do.	7.70	2.40	5.30	....	Watered.
Mrs. J. E. Hall	St. Paul	7.56	1.16	8.40	....	do. & skim'ed.

E. N. EATON, Chemist.

O. F. Chamberlain	Minneapolis	10.43	2.78	7.65	60	Skim & watered.
do.	do.	10.44	3.01	7.43	52	Watered.
Jo. Worsenburg	do.	11.84	2.20	9.64	66	Skim.
H. C. Johnson	do.	10.75	1.60	9.15	61	Skim & watered
do.	do.	11.31	2.00	9.31	68	do.
R. Hanson	do.	11.72	2.76	8.96	68	do.
do.	do.	11.13	2.97	8.16	61	Watered.
H. B. Blood	do.	11.12	3.18	8.94	61	Illegal.
P. Swanson	do.	12.84	3.32	9.52	75	do.
do.	do.	12.73	3.37	9.36	68	do.
R. Brodquist	do.	11.45	2.63	8.82	60	Watered.
C. G. Anderson	do.	10.00	2.04	7.96	70	Illegal.
A. L. McCarger	Dennison	12.33	2.24	10.09	80	Skimmed.
do.	do.	11.53	1.90	9.63	80	do.
B. A. Smith	do.	12.12	2.10	10.02	72	do.
J. E. Orcott	do.	12.48	3.00	9.48	86	Illegal.
A. Vangilder	do.	12.16	2.40	9.75	61	Skimmed.
M. Crumps	do.	11.48	2.47	9.01	73	do.
H. Goodhue	do.	11.86	2.26	9.40	73	do.
John Miller	Minneapolis	11.06	2.60	8.46	80	Illegal.
do.	do.	11.76	2.52	9.24	71	do.
P. E. Neilson	do.	11.93	2.40	9.53	79	Skimmed.
Minneapolis Milk Co.	do.	11.69	2.85	9.84	70	do.
do.	do.	11.87	2.60	9.27	74	do.
City Milk Co.	do.	11.50	2.90	8.60	....	Illegal.
Minneapolis Milk Co.	do.	11.87	2.90	8.97	....	do.
do.	do.	12.00	2.90	9.10	....	do.
C. E. Varnen	do.	12.95	3.10	9.85	77	Skim.
Errikson Bros	do.	11.93	2.62	9.31	82	Illegal.
do.	do.	11.96	2.61	9.35	71	do.
R. Hanson	do.	12.40	2.82	9.58	67	Skimmed.
do.	do.	11.79	2.40	9.34	74	do.
J. N. Krohn	do.	11.50	2.54	....	62	Skim'd & water'd
do.	do.	11.18	2.50	8.68	66	do.
Peterson Bros	do.	11.79	2.29	9.50	77	do.
H. Simonson	do.	10.76	1.97	8.79	68	Skimmed.
Herman Freutel	St. Paul	9.00	2.45	6.55	....	33 per ct. water.
J. Kruenze	do.	11.58	2.71	8.87	....	Illegal.
J. G. Christenson	do.	9.18	2.71	6.47	....	43 per ct. water.
F. Schultz	do.	12.40	3.40	9.00	....	Illegal.
Geo. Staples	do.	10.55	3.11	7.44	60	Watered.
do.	do.	9.88	2.61	7.27	55	do.
Jas. McGrath	do.	11.92	2.98	7.94	70	do.
do.	do.	10.38	2.58	7.80	57	do.
John Miller	do.	11.95	3.05	8.90	....	Illegal.
H. C. Larson	do.	11.15	2.00	9.15	...	do.
E. Coaley	do.	12.09	2.83	9.26	73	Skimmed.
do.	do.	12.40	3.04	9.36	76	do.
M. Stressty	do.	11.60	3.02	8.40	....	Watered.
Bragg Bros	do.	12.00	2.17	9.83	....	Skim.
L. H. Ochts	do.	12.62	2.84	9.78	....	Illegal.
E. Lomdt	Winona	11.80	3.20	9.60	81	Skim.
Unknown	do.	13.43	2.66	10.82	68	do.
H. Paape	do.	11.24	1.94	9.30	61	Watered.
H. Fruetel	St. Paul	9.22	2.80	6.42	46	do.
Geo. N. Welch	do.	10.98	3.00	7.98	...	do.
Herman Fruetel	do.	8.14	2.20	5.94	41	do.

CREAM.

It would seem that as low as is our state standard, 20 per cent. of fat, no illegal cream should be found. That our standard is low may be seen from the recorded analyses of cream from other localities.

H. D. Richmond, of London, Eng. has summarized 1,368 analyses made in his laboratory in 1892, for the Aylesburg Milk Co. The cream was in all probability raised by gravity, deep setting.

	Per cent. fat.
January	46.3
February	47.1
March,	47.0
April	48.3
May	48.3
June	45.9
July	48.5
August	46.0
September	46.6
October	47.1
November	44.3
December	44.2

Clotted cream often runs as high as 56 per cent. fat. The average of American cream, as computed by Hills in 1893, is 18.80. Cream obtained from the DeLava "Alpha" separator gave 21.12 per cent. fat. But few analysis of cream have been made since the last report. The percentage of fat in those analyzed was 8.30, 6.20 and 18.17 per cent.—all below the requirements.

	Per cent. of fat.
Evaporated cream gave	2.40
Condensed milk gave	4.90

Each were manufactured from skimmed milk. There was received in the laboratory this summer a sample labeled cream. From appearances the water had evaporated or filtered out, leaving the residue a semi-solid. The precentage proximate ingredients were:

Water	7.33
Fat	1.66
Combustible fat	90.15
Ash	.85

The combustible portion was found to consist largely of starch or flour, a small amount of albuminoids and milk sugar was present as well as some fat. The cream was then a mixture of starch or flour to which some milk was added.

BUTTER.

It is but the logical result of a cause that a better and more uniform grade of butter is placed upon the market. We have now more complete control of the milk, beginning with the feed and treatment of the cow to the finished product, butter. We have better knowledge of the composition of good butter and its relation to good milk. We are much better acquainted with the agencies causing the ripening of cream, the change it undergoes in ripening and the effect upon the quantity and quality of butter produced. Legislation, national and state, has undoubtedly done much to better the butter product, by heavily taxing imitation products, by enacting and enforcing laws regulating the sale of oleomargarine, by encouraging dairying in the establishment of dairy schools and dairy exhibits, by enforcing the selling of "patent butter," etc., by their proper names. Perhaps some further good might be accomplished in this line as has been strongly contemplated in England, by fixing limits for the ingredients of the article selling under the name of butter. Our state and others have already done this for milk, cream and cheese. By no means an unimportant factor in the production of good butter is the increase of creameries, private and co-operative, admitting the employment of educated and experienced butter makers and the introduction of centrifugal separators. It is impossible now to estimate the value to the dairy industry of paying for milk according to its fat content.

Unquestionably the most prominent scientific investigation of late years in the dairy industry is in the field of bacteriology. Milk being a perfect culture medium for bacteria, there is found in it almost innumerable colonies of micro-organisms. While it is now conceded that milk, when drawn from the cow, care being taken to sterilize everything likely to come in contact with the milk and to exclude air, will not contain germs; yet ordinarily they are found in fresh milk and increase every minute until the milk enters the churn. Indeed, if it were not for certain of these bacteria it would be impossible to produce the fine flavor and aroma of good butter. A great many species of these bacteria, it may be mentioned, are not needed and many which may enter through neglect are perhaps harmful or unhealthful, and certainly injure the flavor and keeping qualities of the butter. Prof. Storch has discovered the pure flavor producing bacteria. Cultures of such bacteria are now on the market for sale, so that by sterilizing "tainted milk" and adding the pure germs for a "starter" the finest butter may be obtained. It is even claimed that they are beneficial to uncontaminated milk by insuring predominance of flavoring bacteria.

The proximate composition of butter, as given by various authors, is as follows:

	Waller.	Average of many analyses
Water	8 to 10	14
Fat	83 to 85	83
Curd	1 to 3	1.2
Ash	3 to 5	....

Vieth furnishes the following figures:

Description.	No. analyz'd.	Water.	Fat.	Curd.	Ash.
English, fresh and salt	72	18-14.4	83-90.5	.02-1.5	00-2.99
English, fresh and salt, average	72	11.5	86.8	.59	1.02
French, salt	108	11.6-15.5	82.6-86.6	1.3-1.8	1.3-2.5
Danish, salt	17	9.5-17.	78.-87.5	.9-2.4	1-.3
Danish, salt, average............	17	13.4	83.4	1.3	1.9
Swedish, average	25	13.7	82.9	1.3	2.0

Of the 267 samples analyzed 94.4 per cent. contained between 10 and 16 per cent. of water, none below 7.0 per cent. or above 18.

The latest figures showing average composition of butter are those of Richmond in "Analyst," March, 1893.

ENGLISH BUTTER GAVE—

	Limits.	Average.
Water	16.49 to 11.58	13.99
Fat..................................	86.19 to 80.14	82.98
Curd................................	1.05 to .62	.89
Ash..................................	3.93 to 1.16	2.14
Reichert Vollny No..................	30. 8 to 24.9	28.10

The "*water*" as usually obtained by evaporation at the temperature of boiling water consists of water and probably some volatile compounds in the butter other than water; however, this gain in weight of water is somewhat balanced by the gain in weight of solids due to oxidation of the fat.

The "fat" consists largely of the glycerides of the fatty acids, stearic, palmitic, myristic, oleic, butyric, capoic, caprylic and capric. Probably the fat instead of being simply glycerides of the fatty acids as $C_3H_5(C_{18}H_{35}O_2)_3$, tri stearin, is a complex glyceride of two or more of them.

$$e.\ g.\ C_3H_5\left\{\begin{array}{l}C_4\ H_7\ O_2\\ C_{16}\ H_{31}\ O_2\\ C_{18}\ H_{33}\ O_2\end{array}\right.$$ A combination of tri-butyrin, tri-palmitin and tri-olein.

The principal reason for believing that the glycerides are combined in this way is that when subjected to the action of solvents, as alcohol, they do not conduct themselves as would single glycerides.

Probably the most complete and correct examination of butter fat is the following, by Koefoed.

The butter examined gave a Reichert number of 15.1—fatty acids 91.5.

Oleic acid Acid of formuloe C_5 H_{28} O_4 Acid of formuloe C_{29} H_{54} O_5 (?)	34.0
Stearic acid	2.0
Palmitic acid	28.0
Myristic acid	22.0
Lauric acid	8.0
Capric acid	2.0
Caprylic acid	.5
Caproic acid	2.0
Butyric acid	1.5

The "*curd*" of butter consists of the solids, not fat of milk less the ash. Any organic antiseptic added to butter, also certain coloring agents would be represented in the "curd." Other abnormal organic constituents as starch and glucose would be calculated as curd. Ordinarily casein is the chief and almost the only constituent of curd; it is in the insoluble condition; albumen, lactose, lactic acid and fibrin are present in traces only. A good creamery butter will contain between .80 and 1.20 per cent. of "curd." Usually the less curd present the better the keeping qualities of the butter. Danish butter contains more "curd" than Irish, English, French or American.

The "*ash*" of butter consists of the inorganic portion of the milk incorporated in the butter with a variable proportion of common salt and other inorganic material added, as saltpeter, lead chromate, borax, etc., which may be used for purifying, coloring or preserving. The "ash" of fresh butter is usually less than one per cent.. and in salt butter seldom over four per cent. The ash of normal butter consists of the phosphates, chlorides and carbonates of potash, soda, lime, magnesia and iron.

It is my opinion that a butter containing over 18.0 per cent. of "water," 3.00 per cent. of "curd" and 6 per cent. of "ash," or less than 80.00 of "fat" should be considered adulterated.

Butter made in different countries differs somewhat in composition. This is due in part to the method of manipulation but somewhat to inherent differences in constitution. Thus Danish butter, on account of little washing and working, contains an unusually large amount of water and curd.

Antipodal butter has a higher percentage of volatile soluble acids. In this country there is a great difference even in creamery butter, although that made from the same factory is usually quite constant in composition. Mention has been made of the influence of feed and period of lactation upon the quantity and quality of milk produced. These factors also affect the composition of milk and hence the butter made from the same. Thus cotton seed in its various forms noticeably decreases the amount of volatile soluble acids and increase the melting point of butter. Probably other foods also influence the butter, but as yet little tentative work has been done in this line. As the period of lactation increases the volatile soluble acids decrease.

Consumers have been so long accustomed to ripened cream butter that they will tolerate no other kind; yet, there are a few people who prefer the taste of sweet cream butter, and it is placed, to a limited extent, upon the market. Ladd finds that there is a great loss in churning sweet cream, at the usual temperature, but by lowering the temperature to 50° to 54° F, there was no greater loss than in the ripened cream. By lowering the temperature the quality was also improved. He finds less casein (curd) in sweet cream butter. Curtis, (Texas,) finds little difference in loss of fat or quality of butter when churned under the same conditions. Patrick finds the yield of butter from ripened cream usually larger than sweet; ripened cream churned quicker, contained less fat, more water and more casein. The loss of fat in churning, washing and working was less with the ripened cream. Sweet cream suffered less deterioration by keeping than ripened cream. A second trial in 1893, confirmed the above result, except that there appeared to be no regular difference in the percentage of casein.

Sometimes butter of all grades, but principally the poorer dairy, becomes rancid and unfit for sale as food. The commission houses buy such butter, wash and treat with chemicals and purifying agents and perhaps antiseptics and, thus patched up, place it upon the market. This summer a butter containing saltpetre and glucose was examined. The saltpetre was used in washing, aiding the washing out of butyric acid, while the glucose was added to make the butter "draw" better. Neither were in sufficient quantity to be considered an adulteration or harmful. When butter cannot be made presentable in this way it is sometimes remelted, purified and churned again with milk. Borax and other antiseptics are often added to such butter. Such practices should be discontinued, not alone because the product is unpalatable, but it lends an edged argument to oleomargarine's advocates.

ADULTERATED BUTTER.

Adulterated butter may be divided into four classes:

1. Oleomargarine.
    - *a* Oleomargarine.
    - *b* Butterine.
2. Oleomargarine and butter.
3. Butter and lard or other animal or vegetable fat.
4. Patent butter.

OLEOMARGARINE: Although all products manufactured in part from animal or vegetable fat other than butter fat, sold for butter or as a substitute for butter, are by the United States law classed as "oleomargarine," yet to the manufacturers oleomargarine is known as a product made exclusively from beef fat or beef fat and butter, while a product made from lard is called butterine.

"Oleo oil," the principal ingredient of oleomargarine, is prepared from tallow rendered at a low temperature, the major part of the stearin of which is removed by cold and pressure. This product, either churned with milk or butter and colored, gives the various grades of oleomargarine on the market: Jersey, Kansas Dairy, Elgin No. 1, etc. Cotton seed oil is added in considerable quantity in winter. Butterine is made in the same manner from hog fat.

It is claimed that oleomargarine is composed of the same ingredients as butter and that there is no ingredient in oleomargarine not found in butter and vice versa. The supporters of oleo have gone farther and claim that oleomargarine is not a substitute for butter, but an artificial reproduction thereof. I am not referring now to the exaggerated claims of the manufacturers but much more trustworthy authority. (See Babcock, J. F., Scientific American, Vol. XXX, No. 757). There is some foundation for the statement, enough to make it misleading, but not enough to make it right. Beef and hog fat consist almost entirely of stearin, palmitin and olein. Butter contains these ingredients, but also many others, as will be noticed from the composition of butter fat. Butter also contains 5 per cent. or more of soluble glycerides of the fatty acids, while oleomorgarine is almost wholly destitute thereof. These glycerides influence the flavor of good butter and probably aid in digestion. Nor are the ingredients of oleomargarine and butter present in the same proportion. Butter contains but a very small amount of stearin, while oleo oil, although a portion of the stearin is extracted from the tallow and is made into candles, still contains a large percentage. Moreover, oleo oil is a mechanical mixture of the glycerides; butter, as before mentioned, is probably a chemical combination of them. These may be as different as the mixture of the gases, hydrogen and oxygen, and the chemical product of their union—water.

HEALTHFULNESS AND WHOLESOMENESS OF OLEOMARGARINE: Upon this subject may be found a variety of opinions. Persons wishing to prove the unwholesomeness of oleomargarine can find able authorities to support their position, while many of the eminent agricultural chemists are arrayed upon the opposite side. Undoubtedly some of the opponents of "bull butter" have been more radical in their views than facts would warrant, as witness one of the former reports of the commission in which a microscopical examination of butterine was made: "Bacteria, protozoo and doubtful portions of worms were noticed;" some bacteria, doubtless identified by rings on their tails, were "intimately connected with the micro coeci of smallpox, erysipelas and diphtheria." On the other hand it seems strange that such an eminent chemist as Dr. A. W. Atwater would allow himself to give an affidavit of purity to an article, the manufacture of which he had viewed but once, and then when everything was prepared for his reception. Oleomargarine toiling for over-production may be much different from oleomargarine on dress parade. Pure oleomargarine, i. e., oleomargarine made from pure oleo oil and cotton seed oil, could not be unwholesome, only in the possibility of contamination could it become so. From beef fat there is little to fear from living organisms. Made from neutral oil there may be a possibility of its containing trichina. By far the greatest opportunity for introduction of extraneous, unwholesome and unhealthful material is in the method of manufacture.

The following from a very conservative report, in fact the most favorable report I have noticed, shows that the popular impression of the unwholesomeness of oleomargarine is not entirely without foundation, and that the manufacturers must give better proof than they have yet been able or willing to give before the people will have entire confidence in their affinity to godliness. The report may be found in the third annual report of the Ohio Dairy and Food Commission.

* * * After we had stopped a few minutes where the hogs are killed, and where the fat is stripped from the intestines, we went directly to the building in which the oleomargarine and butterine are made. We passed through several rooms, first through those in which the product is finished, and advancing through the large building so as to see the butter substitutes in every stage, from the finished product down to the raw fats,

we finally reached the rooms in which the raw materials, the animal fats, undergo the first process, and are thrown into big hoppers to be chopped, or cut up, by machinery. The further we went along the higher we found the temperature, which, as was stated to me upon inquiry, was about 100° F. in the room in which the raw fats are first taken into manipulation. Although the heat was rather oppressive to my companion and myself—the employes stated that it was almost unbearable in the summer—we stayed long enough to watch the proceedings, and to examine several truck-loads of raw fats. A good many of them arrived during our presence. On one side we found the beef fat (tallow) from the kidneys and from the intestines, and were informed upon inquiry that it served for the manufacture of oleomargarine; on the other side we found leaf-lard (kidney fat) and the fat from the intestines (mesenterium and caul) of hogs. The leaf-lard of hogs and the kidney fat or tallow of cattle, arrived in separate cars or trucks, and looked clean enough, but the fats stripped from the intestines of cattle, as well as of hogs, but particularly of the latter, looked rather soiled as if they had been handled with very dirty hands, and in the cars or trucks, which contained the same, we saw here and there small slices of meat and parts of an intestine. One piece of intestine, apparently of the rectum, was at least two feet long. That the mesenterium contained the mesenteric glands, is self-evident. The fats of hogs, we were informed, are used for the manufacture of butter, ine; at any rate, we saw that they went into separate tanks, and were not mixed with the tallow of cattle. * * *

DR. H. J. DETMERS,
Professor of Veterinary Surgery, O. S. U.

It is now universally admitted that oleomargarine is less *easily* digested than butter and its co-efficient of digestion (i. e., relation of digestable portion to the total) has been found to be less than butter.

The oleomargarine upon the Minnesota markets in 1893 I find to be colored yellow by an aniline dye, methyl orange or helianthin. Many of the aniline dyes are poisonous in themselves, but all are liable to contain poison, as arsenic is used in their manufacture. However, in the small quantity that would be taken in the butter color I think there would be no danger of receiving the toxic effects. Their poisonous properties may be endured for the sake of their antiseptic properties.

Oleomargarine, were it not unwholesome, is at least a fraud as it is usually consumed for butter, and is a menace to our farmers and factories. If the bogus product should be colored pink as required by law, there could be less room for objection. Surely this is reasonable, possible and plausible. Among aniline dyes there is eocene pink, the beautiful fast new pink "rhodamine," and probably many others. From the animal kingdom we get carmine which has been found applicable in coloring fats pink. Then there is a perfectly harmless dye from the vegetable kingdom which is a perfect coloring agent for oils and may be applied in the same manner as annotto.

What has been said regarding the manufacture, wholesomeness and coloring of oleo oil is true likewise of the better grade product containing usually about 12½ per cent. of butter fat.

A few mixtures of butter and lard have been discovered by the inspectors. Some of these were mixed by commission merchants and some by country makers. But very little of such product is on the market.

Patent butter is simply a butter containing an abnormal amount of water and perhaps somewhat larger proportion of curd than in normal butter. This "filling" with water is accomplished by the use of some digestive ferment as pepsin or rennet, (black pepsin) which emulsifies the fat, enabling it to take up an equal bulk of milk. During the summer a company was securing agencies in the twin cities for the "great California discovery" for increasing the yield of butter. None of such butter has been received in the laboratory.

The following table records the analysis of adulterated or illegal butter. All figures given by the chemist are recorded. Often a single determination will determine the fact of adulteration and sometimes the approximate amount of adulteration to the satisfaction of the chemist. But when such analysis must be presented to the court as evidence, as has been the case this summer, any one determination is unsatisfactory and the more complete the analysis the better your case.

ANALYSIS OF ADULTERATED OR ILLEGAL BUTTER.

Name of Seller,	Location.	Sold for.	Water.	Fat.	Casein, &c.	Ash.	Vol sol. fatty, A.	Reichert No.	Reichert Vollny No.	Iodine absorption.	Sp. gravity.	Color.	How adulterated.
EBERMAN, Chemist,													
T. Jones	St. Paul	Butter						3.82					Foreign fat.
F. T. Sargent	"	"						.40					Oleomargarine.
Astoria Hotel	"	"						3.43					23.78 foreign fat.
W. R. Allen	"	"						3 34					25.78 foreign fat.
Albert Kasgord	"	"						.35					Oleomargarine.
John Olson	"	"						2.43					.46 foreign fat.
Chas. J. Birch	West Duluth	"	10.43	84.61	2.94	2.14		.38					Oleomargarine.
Marshall House	St. Paul	"	11.14	82.62	3.11	2.21		.37					"
S. Burns	"	Oleo	11.42	80.34	3.81	.4		.35					"
Morgan	"	"						.37					"
Roxie Revers	"	"						.33					"
Sitterly Bros	"	"						.42					"
C. Graves	"	"						3.34					33.2 foreign fat..
Murphy	"	"						.36					Oleomargarine
A. H. Sell & Co.	"	"						.38					"
J. M. Bridges	"	"						.44					"
DREW, Chemist.													
J. Peterson	Minneapolis	Butter							8cc				"
Chas. B. Leich	"	"							9cc				"
W. Manuel	"	"							1cc				"
J. C. Grant	"	"							8cc				"
A. Oltman & F. Frank	"	"							9cc				"
A. D. Babcock	Duluth	"							7cc				"
Knowlton & Carpenter	"	"							1.3cc				"
J. J. Stewart	West Duluth	"							1.8cc				"
F. A. Borem	"	"							7cc				"
B. Nellis	Duluth	"							7cc				"
Rubenach Bros	"	"							2.8cc				"

ANALYSIS OF ADULTERATED OR ILLEGAL BUTTER—*Continued.*

Name of Seller.	Location.	Sold for.	Water.	Fat.	Casein. &c.	Ash.	Vol. Sol. fatty, A.	Reichert No.	Rechter Vollny No.	Iodnie absorption.	Sp. gravity.	Colof.	How adulterated.
EATON, Chemist.													
Chas. J. Johnson	St. Paul	"	5.35	9.65	.97	3.03	.09		.51				Oleomargarine.
E. Constant	"	"	5.93	88.83	1.30	3.94	.08		.46				"
Errikson Bros.	"	"	7.76	83.37	1.88	7.00	3.41		19.4				Mixture.
Kranz & Weideman	Duluth	Oleo	8.50	85.80	1.32	4 37	0.56		.32				Oleomargarine.
Cox Bros.	"	Butter.	8.65	83.60	1.13	6.62	.12		.68				"
J. Wilke	"	Oleo	7.61	86.66	.77	4.96	.14		.84				"
Mosher & Knittle	"	"	8.48	86.32	1.40	3.80	.10		.57				"
J. Wilke	"	"	8.79	86.59	1.14	3.48	.07		.39				"
Walter J. Mears	Minneapolis	Butter.	6.56	91.44	.50	1.50	.54		3.05			Methyl orange.	8 to 12 butter.
Owen Epply	"	Oleo	9.17	89.31	.44	1.08	.51		2.9			"	8 to 10 butter.
W. Severly	"	"	9.95	86.69	.53	2.73	.53		3.			"	8 to 10 butter.
C. O. Miller	"	"	7.88	87.60	1.04	3.48	.06		.33			"	Oleomargarine.
C. Kennelly	"	"	7.69	89.66	.64	2.00	.04		.25			"	"
J. N. Davis	"	"	7 35	90.09	1.18	1.34	.06		.37	.69		"	"
John Nelson	"	"	9.55	86.05	.67	3.72	.06		.33			"	"
Chas. Matson	"	"							.06			"	"
Sample No. 152	St. Paul	Butter.							21.30				Mixed lard & but'r
Sample No. 50	"	"							23.85				"
Simeon Clark & Co.	"	"							.36		90.47		Oleomargarine.
J. Wilke	Duluth	Oleo							.26	55.	90.45	Methyl orange.	Oleo 12 5-10 butter
Minneapolis Prov. Co	Minneapolis	"							3.91	49.3	90.50		Oleomargarine.
Unknown		"							.65	53.9	90.45		"

CHEESE.

An examination of the table of analyses will show that the standard of Minnesota full cream cheese has been fully maintained. Due largely to the efforts of Minnesota, Wisconsin and Iowa dairymen, there has been an increased demand for full cream cheese. Indeed, while but a few years ago it was thought that not only was the best made cheese from Holstein milk, but that it was impossible to manufacture cheese from rich milk without great loss of fat. Now it is possible to manufacture cheese from good and even "rich" milk with practically no loss of fat in the pressing or in the whey. The most complete and instructive work of late years in this line has been done by the Iowa experiment station; fifteen cheese were made from milk, varying in fat content from partially skimmed milk to milk to which cream was added. The milk, the first and second whey, the press drip and the resulting cheese were analyzed, and the loss in fat and albuminoids in manufacture determined.

The following is a condensed table of results:

TABLE NO. II.

Showing the pounds of milk required to make one pound of cheese, the pounds of cheese made from one pound of fat, and the loss of fat, casein and albumen during the process of manufacture.

Number of cheese.	Per cent. fat in milk.	Pounds milk required to make one pound green cheese.	Pounds of cheese made from one pound of fat in milk.	Per cent. fat in first whey.	Per cent. lost of the original am't of fat in the milk.	Per cent of casein and albumen in the milk.	Per cent. lost of original amount of casein and albumen in the milk.
1	1.75	12.62	4.39	.15	7.7	3.72	19
2	2.49	11.16	3.59	.17	6.3	3.88	24
3	3.07	10.85	3.00	.17	4.9	3.05	23
4	3.58	10.06	2 77	.13	3.4	2.70	22
5	4.05	10.11	2.44	.34	7.6	3.00	25
6	4.07	9.80	2 50	.28	6.2	3.03	22
7	4.20	9.17	2.59	.26	6.2	3.03	20
8	4.61	8.60	2.52	.38	7.4	2.94	24
9	4.98	8.55	2.34	.63	11.6	2.75	24
10	5.10	7.86	2.49	.54	11.6	2.89	25
11	5.45	8.34	2.20	.45	7.2	2.74	26
12	6.18	7.43	2.17	.43	8,1	2,99	25
13	6.81	7.64	1.92	.66	13.4	2.84	24
14	6.83	7.13	2.04	.33	4.2	2.94	22
15	8.40	6.01	1.97	65	7.4	3.00	23

Attention is particularly called to column No. 5.

It appears then that there is no definite relation between the fat content of the milk and the loss of fat in manufacture. This result has also been obtained in Minnesota and Vermont.

Other things being equal, a cheese containing a large percentage of fat is better because, first, of finer flavor and taste; second, of its better consistency; third, of its improved aroma; fourth, of its increased digestibility; fifth, of its more perfectly answering the requirements of a perfect single food (balanced ration).

As improved cheese is placed upon the market the people are educated into using cheese as a staple food to a much greater extent than formerly. The full cream cheese leads the van, while the skim is relegated to the rear.

The table of analyses shows that Minnesota dairymen have kept much in advance of Minnesota law. Yet it is a matter of regret that cheese varying so greatly in composition and value should parade under the same label. Uniformity as well as quality must be considered in creating and maintaining the demand for a certain brand of cheese. While with no spur but their collective interest and individual reputation, the great majority of Minnesota dairymen have produced an excellent grade of cheese, yet, a few have not only made cheese from very poor milk but from partially skimmed milk. In so doing they tend to drag down the reputation of the standard state brand. In fixing a standard for full cream cheese, it is necessary to show the relation of the milk from which the cheese is made to such standard.

Calculating from a milk containing 3.50 per cent. fat, allowing 3.00 per cent. for albuminoids (certainly low enough) calculating the ash in cheese at 18 per cent. of the casein curiously a fairly constant factor as shown by analyses; making allowance for the loss of fat and albuminoids occurring in the manufacture of properly made cheese, we get 51.9 per cent. of FAT TO TOTAL SOLIDS. This figure may be a trifle high, due to the small and variable amount of lactic acid in cheese. As the abstraction of fat does not greatly change the composition of non fatty solids. this milk skimmed to 2.00 per cent. of fat, allowing for the losses already mentioned, could be manufactured into a cheese containing 40 per cent. of fat to solids—the present state standard for Minnesota full cream cheese.

How do these calculated figures compare with the direct analysis of cheese? I have calculated the ratio of fat to solids in the experiment referred to above, using, however, the figure for total solids derived from the subtraction of the percentage of moisture from 100 per cent. instead of that obtained by the addition of the various ingredients of the solids as found by analysis. If it were not for unrecognized or unknown components of the solids and errors of analysis these figures should be identical. The indirect figure for solids gives a percentage of fat to solids .2 to 2. per cent. less than that derived from the given figures for solids.

No.	Per cent. of Fat in milk.	Per cent. of Fat to solids in cheese.
1	1.75	37.3
2	2.49	43.8
3	3.07	49.0
4	3.58	53.0
5	4.05	55.1
6	4.07	55.3
7	4.20	58.2
8	4.61	59.8
9	4.98	62.5

It will be noticed that milk reduced by skimming to 1.75 per cent. fat, or one-half of our legal standard for milk, can be manufactured into a cheese almost complying with our state standard for full cream cheese. No. 4, just within the standard for fat, makes a cheese containing 53.0 of fats to solids. Both closely agree with the calculated figures.

Referring to the work of the commission:

	M'p'l's dep't.	St. Paul dep't.
The average of all analysis in 1887-88	48.33	42.36
do do do 1889-90	50.14	50.13
do do do 1890-92	49.66	49.48
do do do 1892-93	48.90	50.99
do do do 1892-93	49.90	
do of state fair cheese 1892-93	47.42	51.10

It should be remembered that these analyses include many cheese which were manufactured from partially skimmed milk but which the chemist must report as full cream. Cheese analyzed in the Minneapolis department ran uniformly lower in fat in samples that should have analyzed about the same. This can only be accounted for by difference in method of analysis.

Prof. Harry Snyder, of the Minnesota experiment station, found over 40 per cent. of the total solids to be fat in cheese made from milk containing 2.75 and 2.80 per cent. of fat respectively. In normal milk containing 3.50 per cent. of fat he found over 50 per cent. of the total solids to be fat.

It seems to me that our legal standard for "Minnesota full cream cheese" should be at least sufficiently high to correspond with our minimum percentage of fat as established by law. A ratio of 50.00 per cent. of fat to solids, i. e., one-half of the total solids fat would allow all cheese properly made from 3.50 per cent. milk and better to be labelled and sold as "*Minnesota State Full Cream Cheese.*" I am satisfied that if such a standard were adopted there would be a yet greater demand for Minnesota full cream cheese at home and abroad.

CHEESE. EBERMAN, Chemist.

	NAME OF FACTORY.	LOCATION.	Per cent. of Fat to Solids.
1	Alma City	Alma City, Wis	53.65
2	Rock Dell	Rock Dell	51.83
3	E. B. Scrimpton	Unknown	51.66
4	Crescent Creamery Co	St. Paul	50.14
5	P. H. Kelly Mer. Co	"	51.00
6	Geo. R. Newell & Co	Minneapolis	50.00
7	Minneapolis Milk Co	"	50.42
8	Allen, Moon & Co	St. Paul	49.22
9	Unknown	Unknown	50.90
10	Union Hill	Union Hill	51.08
11	E. P. Stacy & Son	Minneapolis	53.80
12	Poehler & Co	Henderson	49.16
13	P. H. Kelly Mer. Co	St. Paul	48.92
14	Seabury & Co	"	48.91
15	Union Hill	Union Hill	51.76
16	John R. Rentzes	Heidelburg	52.46
17	P. H. Kelly Mer. Co	St. Paul	48.19
18	Patterson & Co	Mankato	44.80
19	Geo. R. Newell & Co	Minneapolis	50.00
20	Rock Dell	Rock Dell	48.25
21	Crescent Creamery Co	St. Paul	47.42
22	Alma City	Alma City	52.53
23	Owatonna	Owatonna	51.54
24	Norman Beebe	Garden City	51.52
25	"	"	50.27
26	Griggs, Cooper & Co	St. Paul	48.15
27	Heidelburg	Heidelburg	52.26
28	P. H. Kelly Mer. Co	St. Paul	48.19
29	Jones Factory	Lake Crystal	50.90
30	Norman Beebe	Garden City	52.66
31	"	"	49.29
32	Wm. Mason	"	52.60
33	Patterson & Co	Mankato	50.91
34	Norman Beebe	Garden City	50.72
35	Harrison & Farrington	Minneapolis	51.55
36	White & Co	Charles City, Ia	51.22
37	Dean Bros. & Lincoln	Chicago, Ill	48.62
38	Cresco	Cresco, Ia	50.75
39	Manning	Unknown	51.71
40	Griggs, Cooper & Co	St. Paul	50.88
41	"	"	50.77
42	P. H. Kelly Mer. Co	"	49.79
43	Ransom Bros	Albert Lea	50.77
44	"	"	49.52
45	J. B. Barnes	Centre Creek	50.08
46	Ransom Bros	Albert Lea	51.69
47	"	"	51.62
48	Austin	Austin	51.50
49	Ransom Bros	Albert Lea	52.14
50	Alma City	Alma City	51.97
51	Factory No. 102	Wilder	51.42
52	" 102	"	48.82
53	Unknown	Unknown	52.35
54	Harrison, Farrington & Co	Minneapolis	52.36
55	Unknown	Unknown	54.72
56	Factory No. 121	Waterville	47.11
57	Havana	Havana	53.24
58	Geo. R. Newell & Co	Minneapolis	53.17

CHEESE. EBERMAN, Chemist.

	NAME OF FACTORY.	LOCATION.	Per cent. of Fats to Solids.
59	P. H. Kelly Mer. Co.	St. Paul	51.67
60	Jones	Lake Crystal	46.50
61	Patterson & Co	Mankato	52.51
62	Norman Beebe	Garden City	51.50
63	“	“	50.95
64	“	“	51.34
65	White's Factory	“	50.73
66	R. Schillets	Madelia	55.00
67	Factory No. 102	Wilder	52.02
68	“ 88		51.45
69	“ 07		56.37
70	Medford	Medford	52.95
71	Union Hill	Union Hill	52.01
72	Medford	Medford	52.46
73	Factory No. 95	Unknown	50.58
74	Lone Rock	Lone Rock	47.00
75	Merton	Merton	51.63
76	“	“	51.74
77	“	“	52.38
78	Meneke & Hohenaden	Unknown	54.00
79	Havana	Havana	51.87
80	“	“	53.05
81	Mertin No. 121	Mertin	53.12
82	“	“	53.90
83	Owatonna	Owatonna	52.64
84	Samples from State Fair		50.21
85	“		51.01
86	“		53.58
87	“		51.76
88	“		51.30
89	“		51.25
90	“		52.89
91	“		52.21
92	“		52.13
93	“		52.15
94	“		49.59
95	“		50.47
96	“		51.04
97	“		50.28
98	“		51.73
99	“		51.27
100	“		51.25
101	“		50.89
102	“		51.16
103	“		51.31
104	“		51.65
105	“		51.67
106	“		50.96
107	“		52.05
108	“		50.42
109	“		51.59
110	“		52.19
111	“		52.16
112	“		51.01
113	“		50.49
114	“		51.61
115	“		51.84
116	“		53.96
117	“		51.03

CHEESE. **Eberman**, Chemist.

	Name of Factory.	Location.	Per cent. of Fats to Solids.
118	Samples from State Fair		52.03
119	“		52.64
120	“		51.79
121	“		49.36
122	“		49.42
123	“		51.44
124	“		51.19
125	“		49.62
126	“		50.30
127	“		50.52
128	Turtle Creek	Unknown	48.22
129	Lansing	Lansing	50.27
130	“	“	50.59
131	“	“	50.27
132	Turtle Creek	Turtle Creek	48.72
133	“	“	47.12
134	“	“	47.74
135	Lansing	Lansing	49.16
136	“	“	51.61
137	Ransom Bros	Albert Lea	52.42
138	Turtle Creek	Turtle Creek	49.37
139	Lansing	Lansing	50.27
140	“	“	47.75
141	Ransom Bros	Albert Lea	52.65
142	Sauk Center	Sauk Center	55.16
143	Fergus Falls	Fergus Falls	54.84
144	Western Factory, No. 29		50.42
145	Willmar	Willmar	55.64
146	“	“	54.98
147	Hasted, No. 113		58.07
148	Swan Lake	Swan Lake	52.03
149	Centre, Wis.		43.94
150	Harrison, Farrington & Co	Minneapolis	50.72
151	Havana	Havana	51.94
152	“		52.73
153	Unknown		53.28
154	Redwood Falls	Redwood Falls	51.76
155	“	“	53.55
156	“	“	52.38
157	Allen, Moon & Co	St. Paul	48.51
158	Bradbury & Hall	Minneapolis	51.71
159	Redwood Falls	Redwood Falls	53.64
160	“	“	54.29
161	Griggs, Cooper & Co.	St. Paul	53.54
162	L. Patterson & Co	Mankato	54.95
163	“	“	50.00
164	Latch & Co.		51.57
165	Unknown		43.97
166	Lyon County Factory		51.63
167	P. H. Kelly Mer. Co.	St. Paul	51.60
168	Sprague, Warner & Co	Chicago	53.14
169	John A. Tolman & Co		51.55
170	Beuupre Mer. Co	St. Paul	50.84
171	Griggs, Cooper & Co.	“	48.27
172	“	“	50.60
173	Rock Dell	Rock Dell	48.67
174	Merton	Merton	47.85
175	Merton	“	51.51

CHEESE. **EBERMAN**, Chemist.

	NAME OF FACTORY.	LOCATION.	Per cent. of Fats to Solids.
176	Woodward & Stone	Watertown, Wis.	47.55
177	"	"	52.49
178	Havana, No. 41	Havana	47.76
179	" 42	"	48.52
180	Havana	"	51.78
181	Stow Brand		49.86
182	Factory No. 7		53.61
183	Frazee City	Frazee City	49.37
184	"	"	52.51
185	"	"	54.42
186	Anthony Kelly & Co	Minneapolis	50.00
187	Reed, Murdock & Co	Chicago	48.47
188	Hamden	Hamden	51.92
189	R. A. Durker & Co	St. Paul	52.70
190	Geo. R. Newel & Co	Minneapolis	47.00
191	"	"	47.48
192	Harrison, Farrington & Co	"	48.37
193	Twohey Mer. Co	West Superior, Wis.	49.42
194	Vidger & Lewis	Fargo	47.43
195	W. L. Chappell, No. 1		53.84
196	Wisconsin		48.12
197	McConkey	Fergus Falls	50.64
198	"	"	49.62
199	"	"	48.44
200	"	"	52.95
201	Allen, Moon & Co		49.36
202	Western Factory		50.55
203	"		49.65
204	"		50.96
205	"		51.28
206	Factory No. 1		50.03
207	"		50.63
208	"		50.21
209	Wells, Stone Co		50.71
210	Factory No. 1		50.00
	Mean		50.99
	DREW, Chemist.		
2	Lake Crystal	Lake Crystal	45.69
3	"	"	48.40
4	"	"	48.21
5	"	"	47.64
6	Kelley & Robertson	Owatonna	47.19
7	Alma City	Alma City	49.03
8	"	"	45.84
9	"	"	49.21
10	"	"	41.77
11	"	"	49.52
12	"	"	48.33
13	P. H. Kelley Mer. Co	St. Paul	45.79
14	Koehler & Hendrix	"	44.79
15	Factory No. 41		48.68
16	" 125		49.21
17	" 143		47.92
18	Jacob Miller	Milwaukee	48.67
19	Ransom Bros	Albert Lea	48.61
20	"	"	50.77
21	"	"	51.26

CHEESE. DREW, Chemist.

	NAME OF FACTORY.	LOCATION.	Per cent. of Fats to Solids.
22	Ramsom Bros		50.31
23	"		50.66
24	Factory No. 121		50.77
25	" 21		51.65
26	" 68		50.27
27	Chicago		46.13
28	Iowa		46.43
29	Lake Crystal		50.14
30	Iowa		47.00
31	"		50.49
32	Geo. R. Newell & Co	Minneapolis	49.77
33	Harrison, Farrington & Co	"	47.83
34	Factory No. 95		50.57
35	" 102		51.15
36	" 102		50.67
37	" 102		52.15
38	Sprague, Warner & Co	Chicago	45.75
39	Sioux City	Iowa	46.10
40	"	"	46.88
41	Reid, Murdock & Co	Chicago	48.23
42	P. H. Kelley Mer. Co	St. Paul	48.37
43	" "	"	49.40
44	Beaupre Mer. Co	"	49.22
45	Allen, Moon & Co	"	50.91
46	" "	"	48.81
47	" "	"	49.48
48	Viroqua	Viroqua, Wis	47.23
49	Chicago	Chicago	46.87
50	Dakota		48.69
51	Koehler & Hendrix	St. Paul	48.85
52	Unknown		47.49
53	Roscoe		46.56
54	Rock Dell	Rock Dell	50.44
55	"	"	50.98
56	"	"	51.52
57	"	"	49.43
58	"	"	49.39
59	"	"	50.43
60	"	"	51.13
61	"	"	50.32
62	"	"	49.00
63	State Fair samples		47.46
64	" "		47.35
65	" "		47.07
66	" "		48.37
67	" "		47.06
68	" "		44.46
69	" "		44.89
70	" "		45.78
71	" "		44.51
72	" "		47.64
73	" "		44.61
74	" "		46.46
75	" "		48.94
76	" "		48.28
77	" "		49.08
78	" "		45.85
79	" "		47.93
80	" "		46.82

CHEESE. DREW, Chemist.

	NAME OF FACTORY.	LOCATION.	Per cent. of Fats to Solids.
81	State Fair samples		45.34
82	" "		44.82
83	" "		44.98
84	" "		52.94
85	" "		47.37
86	" "		49.09
87	" "		54.09
88	" "		48.59
89	" "		47.70
90	" "		43.37
91	" "		49.00
92	" "		48.18
93	" "		45.34
94	" "		50.16
95	" "		43.85
96	" "		48.00
97	" "		48.59
98	" "		48.74
99	" "		49.36
100	" "		47.06
101	" "		46.19
102	" "		44.44
103	" "		52.32
104	" "		42.16
105	" "		47.38
106	" "		53.22
107	" "		49.16
108	Crescent Creamery Co.	St. Paul	48.24
109	Pine Island	Pine Island	49.56
110	"	"	49.15
111	"	"	49.73
112	Morrill & Son	Rochester	49.25
113	Rock Dell	Rock Dell	49.49
114	"	"	50.73
115	"	"	48.97
116	Allen, Moon & Co.	St. Paul	46.94
117	Minnesota Mer. Co		47.60
118	Twohey Mer. Co.	Superior	47.41
119	Unknown	St. Paul	49.34
120	Harrison, Farrington & Co.	Minneapolis	48.15
121	R. A. Durkee & Co.	St. Paul	49.77
122	Griggs, Cooper & Co	"	47.69
123	Lambert & Co		48.60
124	Unknown		47.41
125	Factory No. 116.		50.35
126	" 116.		50.17
127	Streissguth Mer. Co.	Arlington	48.54
128	Crescent Creamery Co.	St. Paul	50.44
129	P. H. Kelley Mer. Co.	"	47.34
130	Factory No. 97		49.25
131	Unknown		47.55
132	Factory No. 137		50.91
133	Chicago		46.97
134	Seabury & Co	St. Paul	44.34
135	Geo. Dixon	Minneapolis	45.15
136	Geo. R. Newell & Co	"	47.34
137	" "	"	49.49
138	" "	"	50.14
139	" "	"	51.45

CHEESE. Drew, Chemist.

	Name of Factory.	Location.	Per cent. of Fats to Solids.
140	Seabury & Co.	St. Paul	48.56
141	“	“	47.69
142	“	“	47.47
143	Stone, Ordean &Co	Duluth	48.54
144	“ “	“	49.19
145	“ “	“	46.81
146	“ “	“	47.97
147	“ “	“	49.44
148	“ “	“	51.41
149	Dunham & Johnson	Minneapolis	50.20
150	Merton Factory	Merton	48.46
151	Harrison, Farrington & Co		48.39
152	Stone, Ordean & Co	Duluth	46.92
153	Seabury & Co.	St. Paul	48724
154	Unknown		52.77
155	Cedar Mills No. 141	Cedar Mills	52.82
156	“ “	“	52.27
157	“ “	“	52.03
158	“ “	“	51.58
159	“ “	“	51.10
160	“ “	“	51.29
161	P. H. Kelley Mer. Co.	St. Paul	48.58
162	“ “	“	49.20
163	“ “	“	48.82
164	“ “	“	49.15
165	“ “	“	50.09
166	Sumter Factory	Sumpter	51.59
167	Unknown		49.86
168	“		49.43
169	“		47.00
170	“		48.68
171	“		49.21
172	“		48.24
173	“		48.67
174	“		48.23
175	“		46.43
176	“		49.31
177	“		44.79
178	“		48.53
179	“		48.53
180	“		48.71
181	Smith & Peterson	Wisconsin	48.95
182	P. H. Kelley Mer. Co.	St. Paul	49.52
183	“ “	“	50.66
184	Anthony Kelley Mer. Co	Minneapolis	50.93
185	Swan Lake	Swan Lake	50.27
186	Anthony Kelley Mer. Co	Minneapolis	49.79
187	Seabury & Co	St. Paul	48.71
188	Harrison, Farrington & Co	Minneapolis	51.01
189	“ “	“	50.49
190	“ “	“	50.50
191	Dunham & Johnson	“	52.73
192	T. G. O'Brien		54.36
193	Geo. R. Newell & Co	Minneapolis	51,29
194	Crescent Creamery Co	St. Paul	51.10
295	“ “	“	50.49
196	Johnson, Norman & Co		51.22
197	Johnson & Co		51.00
198	Potts Bros		50.93

CHEESE. DREW, Chemist.

	NAME OF FACTORY.	LOCATION.	Per cent. of Fats to Solids.
199	Havana	Havana	50.95
200	Unknown		49.49
201	"		49.67
202	"		49.15
203	"		51.41
204	"		48.64
205	"		49.32
206	"		47.58
207	"		47.60
208	"		46.81
209	"		50.89
210	"		49.57
211	Potts Bros	St. Paul	49.26
212	"	"	48.62
213	"	"	50.89
214	"	"	52.11
215	"	"	51.10
216	"	"	50.34
217	Allen, Moon & Co	"	51.00
218	Menk Bros	"	50.77
219	"	"	48.24
220	"	"	51.38
221	Baldwin	Baldwin, Wis	49.57
222	"	"	48.54
223	"	"	49.34
224	Potter, Lucas & Co	St. Paul	51.01
225	Austin & Nicholas		50.63
226	Muscoda	Muscoda	48 62
227	Hoskimen & Co		52.12
228	Reid, Murdock & Co	Chicago	49.77
	Mean		**48.90**

ANALYSES OF ILLEGAL OR ADULTERATED CHEESE—EATON, Chemist.

SELLER.	Water.	Fat.	Curd.	Ash.	Fat to solids.	Coloring.	How adulterated.
B. F. Mann & Co	22.11	42.47	31.21	4.21	54.51		Filled.
Golden Rule, St. Paul	31.94	22.48	41.84	3.74	33 03		Skimmed.
C. W. Clark, Owatonna	41.32	14.18	40.12	4.39	24.17	Annotto	Skimmed.
E. W. Piper, Owatonna	38.95	7.23	48.89	4.93	11.84	Annotto	Skimmed.

LARD.

In the latter part of 1892, while a number of samples were analyzed, but two illegal samples were procured. In 1893, a larger percentage of lard examined was adulterated. In a few cases a mixture of cotton seed oil and beef stearin was sold as lard. Others contained lard as a base with cotton seed oil or stearin or both added. Water was found an occasional adulterant. Pure lard should contain but a trace of water only.

Nos. 9 to 36 were lards procured at random in the Minneapolis market. Those rendered by the butcher were as a rule free from sophistication, although a few contained tallow.

ANALYSES OF LARD.

MANUFACTURER.	DEALER.	LOCATION.	SOLD AS	Water.	Color test with sulphuric acid.	Bechi reaction.	Absorption capacity for iodin.	Microscopic indications.	Found to be
DREW, Chemist.									
Cudahy Packing Co.	O. W. Brown	Minneapolis	Lard		Brown black	Very free red'n	72.4	Beef and l'rd stearin	Adult'rated-beef and l'rd stearin.
N. F. Fairbanks	Mills Bros. & Hansen	Morris	do		do	do			Adult'rated with cotton seed oil.
EATON, Chemist.									
Cudahy Packing Co.	A. Stringer	Minneap'lis	do		Dark brown	do	50.6	Beef stearin	Compound lard.
do	F. J. Holmquist	do	do		do	do	58.	do	do
do	Frank Frink	do	do		do	do	58.9	do	do
Wilson, Morris & Co.	Golden Rule	St. Paul	do		Light brown	Faint reduction	54.8	do	Doubtful.
Unknown	Theo. Veigman	do	do		Light straw	No matr'l red'n	52.41	do	Adult'rated-beef stearin added.
Rend'rd. in laborat'ry		do	Mutton fat				36.2	Mutton fat stearin	Crystal.
Local	Sample No. 1009	Minneapolis	Lard				64.5	Lard crystal	
Swift & Co	do 1010	do	do		Light brown		61.7	Indefinite	Passed.
Local 1011	P. Newman	do	do				55.	Lard stearin	
do 1012	John Webber	do	do				56.9	Beef stearin	Adult'rated with beef fat.
do 1013	Gotsworth & Miller	do	do				55.2	Doubtful	Passed. [water.
J. O'Leary & Co. 1014	Johnson & Co.	do	do	6.89		Slight reduct'n.	57.5	Lard stearin	Adult'rated with
Local 1015	Henry Kraft	do	do				52.7	do	Passed.
do 1016	Vana Bros.	do	do				59.7		Passed.
do 1018	W. C. Bracks	do	do				58.5	do	Lard.
do 1019	C. Wagenshols	do	do				59.4	do	Lard.
do 1020	Bender & Stalke	do	do				56.6	Doubtful	Passed.
do 1021	Louis Greis	do	do				55.3	L'rd and beef stearin	Adult'rated with beef stearin.
do 1022	A. Kivas	do	do				58.5		Lard.
do 1023	W. A. Kelley & Co.	do	do			Mdm. he'vy red	62.7	Doubtful	Passed.
do 1024	W. C. Stringer	do	do				59.4		Lard.
do 1025	J. Bogenkorf	do	do				60.		Lard.
Mpls. Stk. Yds. Co.	C. H. Prilla	do	do	8.08		Slight reduct'n	61.2		Lard.
Swift & Co	Mohrbeck & Oberg	do	do			do	63.9	Doubtful	Passed. [water.
Armour Packing Co.	T. Tailson	do	do	.08		Slight color	59.3		Adult'rated with
John O'Leary & Son.	Grath & Son	do	do	6.38		Medium heavy.	58.7	Doubtful	do
Mpls. Stock Yards	H. H. Ockney	do	do			Very slight	64.1		
Sample 1031	Sulger & Farrer	do	do	.25		Slight red'n	65.		do
do 1032	Johnson & Egan	do	do			do	58.2	Lard stearin	Lard.
Twin City Pack. Co.	J. Ettel	do	do		Slight color		54.9		Adult'rated with beef stearin.
John O'Leary & Son.	Fellows & Metcalf	do	do	6.85		do	58.	Beef stearin	Water.
J. C. Johnson & Co.	Foreburg & Scharten	do	do	6.84			61.3		Water.
Mpls. Stk. Yard Co.	Londserh & Russeth	do	do		Dark brown	Very heavy per	62.	Beef stearin	Compound lard.

VINEGAR.

A large number of samples of vinegar have been analyzed in the last four years, The usefulness of this work cannot be over-estimated and is self-evident to the purchaser of pure vinegar. Forms of adulteration, prevalent in the past, have been practically abandoned. Still as one form of sophistication is eradicated the enterprising manufacturer finds other and more ingenious ways of defrauding the public and evading of the law. Only a mention of some of these vinegars will be made in this report, but at some future time I hope to give more attention to this branch of our work. There is now made and placed upon the market:

Low wine vinegar, sometimes called white wine; low wine vinegar, colored; glucose vinegar, colored, and usually flavored; malt vinegar, proper; malt extract vinegar; low wine vinegar, to which malt extract has been added; cider vinegar, proper; cider vinegar, made from cider extract; cider vinegar, made by quick process; combination of cider with other vinegars.

As before stated some of these vinegars have but lately been placed on the market and it may be a difficult matter for the chemist, without taking time for an especial investigation, to distinguish them; as for example, to recognize cider vinegar made by the quick process. Yet the formation of amides by the old and natural process and some sensitive tests I have discovered further lead me to believe that it is not impossible to detect this method of deception.

In the St. Paul department of the 161 samples analyzed, 63 were white wine, 80 cider, 4 glucose, 13 malt extract and white wine and 1 combination; 24, or about 15 per cent., were adulterated; of the adulterated samples 15, or 62 per cent., were misbranded and 18, or 75 per cent., were illegal, i. e., deficient in acidity or solids.

In the Minneapolis department 363 samples of vinegar were analyzed, of which 61, or 17 per cent., were adulterated or illegal; of the adulterated samples 20, or 33 per cent., were colored, 19, or 31 per cent., were deficient in acidity and 41, or 67 per cent., misbranded.

ANALYSES OF VINEGAR.

Manufacturer.	Seller.	Location.	Sold for—	Found to be—	How adulterated
Spink & Son	Bottom Bros	Little Falls	White wine		Def. in acid.
Spink & Son	do	do	Pure cider	White wine added	
Spink & Son	M. G. Paine & Son	Staples	Malt	White wine, malt ex. ad'd	Def. in acid.
Spink & Son	John Gillespie	do		do	
Spink & Son	S. W. Reynolds	Verndale	Malt	do	Def. in acid.
Spink & Son	F. Gores	Medina	do	do	do
Seabury & Co	Beach, Cole & Beach	Brainerd	Red wine vinegar	White wine colored	
Stone, Orden & Co	White, Field & Co	Park Rapids	Malt do	do malt ex. added	do
Gedney Pickling Co	F. & T. Nelson	Henning	Cider do	Cider	do
Alden Vinegar Co	McCuene & Fogleson	Kenyon	West India Spiced vin'g'r	Colored glucose vinegar.	do
Alden Vinegar Co	W. H. Weibler	Belle Plaine	do	do	do
Alden Vinegar Co	McCune & Fogleson	Kenyon	Extra pure Geneton	do	do
Alden Vinegar Co	W. H. Weibler	Belle Plaine	West India spiced vin'g'r	do	do
New Ulm Vinegar Works	Wm. Henry & Co	do	White wine do		do
Alden Vinegar Co	E. Wolf	Henderson	Ex. pure white wine v'g'r		do
Franklin McVeagh & Co	F. S. Witherbee	Marshall	Queen vinegar	Cider	do
Spink & Son	Michuad Bros	St. Paul	Pure malt	White wine, malt ex. ad'd	do
Spink & Son	P. H. Gross	do	do	do	
Spink & Son	Blake & Butterfield	Little Falls	do	do	
Red X Vinegar Works	do	do		do	
Reid, Murdock & Co	E. W. Davis	Detroit	Cider vinegar	Colored white wine	Illegal.
Spink & Son	Wanested & Wangenstein	Lake Park	Pure cider	Cider	
Red X Vinegar Works	H. Rogers	Moorhead	Cider vinegar	White wine and cider	
E. M. Rawworth	John Marih	Barnsville	Red wine vinegar	Colored white wine	
Alden Vinegar Co	H. E. Torrence	Worthington	Pure old vinegar	Glucose vinegar	Def. in acid.
Alden Vinegar Co	Finnes Bros	Adrian	White wine	do	do
Alden Vinegar Co	A. L. Ebe	Pipestone	West India spiced	do	
Unknown	H. E. Torrence	Worthington	No brand	Low wine	Colored.
Marshal't'n Vin'g'r & Pklng wks	W. H. Glass	Luverne	Pure cider	Repressings	
Marshal't'n Vin'g'r & Pklng wks	do	do	White wine	White wine	Def. in acids.
Reid, Murdock & Co	Nelson Bros. & Co	do	Cider	Low wine	Colored.
Spink & Son	E. B. Burdey	do	Red wine	do	do
Spink & Son	W. W. Gilbirk	Rochester	Malt vinegar	do and grain solids	Def. in solids.
Spink & Son	J. O. Sands	Zumbrota	do	do	
New Ulm Vinegar Works	A. M. Bicken	Adrian	White wine	White wine	Def. in acid.
New Ulm Vinegar Works	S. J. McKensie	do	Pure cider	Repressings	
New Ulm Vinegar Works	Johnson & Diesen	Heron Lake	White wine	White wine	Def. in acid.
Alden Vinegar Works	C. H. Phelps	Echo	do	Low wine	do
Alden Vinegar Works	do	do	Spiced vinegar	Glucose vinegar	Colored.
Gedney Pickling Co	J. M. Weeks & Co	Pipestone	West India spiced vin'g'r	do	
Red Seal Vinegar Co.	S. Olsen	Cannon Falls	Cider	Repressings	
Jas. Cushing, Son & Co	W. W. Jewell	Pine Island	Colored white wine	Low wine vinegar	
Jas. Cushing, Son & Co	John Anderson	Zumbrota	Malt vinegar	do	Colored.
Alden Vinegar Works	C. H. Botson	Bird Island	Extra spiced vinegar	Glucose do	do

Unknown	J. J. Guile & Co	Echo	No brand	White wine	Def. in acids.
Unknown	H. E. Dye & Co	Morris	do	Low do	Colored.
Spink & Son	H. Patterson	Clarksfield	Cider	do wine grain, solids	
Spink & Son.	H. A. Larson	Madison	White wine	do	
Spink & Son	Invalex & Swan	do	Cider	do	
Spink & Son.	C. Henry	Glencoe	Malt	do	
Spink & Son	J. J. Buchset	do	Cider	do	
Spink & Son	Debruths	Granite Falls	Low wine	do	
Spink & Son	Crow Bros	Graceville	Cider		Def. in solids.
Spink & Son	C. Meyer	Buffalo	Malt	Low wine, malt solids	
Watertown	Gunderson & Rolland	Dawson	White wine	Low wine, grain solids	
Red Seal	F. C. Blass	Glencoe	Malt	do	
Alden Vinegar Works	V. E. Forcer	Stewart	Cider	Glucose vinegar	Colrd, d'f. in solids,
Alden Vinegar Works	J. T. Maxwell	Hector	do	do	Def. in acid.
Alden Vinegar Works	M. Rich	Renville	White wine	White wine	do
Jas. Cushing & Son	H. N. Berger	Montevideo	Cider	Colored wine, apple sol'ds	
Jas. Cushing & Son	Lathrop & Inland	Appleton	Wine	Low wine	Colored.
Jas. Cushing & Son	Miller & Wright	do	Cider	Cider solids, low wine	
Griggs, Cooper & Co	W. D. Burn	Buffalo	do	Low wine, grain solids	
Griggs, Cooper & Co	Smith & Busse	Browns Valley	Cider	do	
Unknown	Louis Krack	Buffalo	Malt	do	
Jas. Cushing & Son	N. M. Jost	Mankato	Cider	do malt do	
Barrett Pressing Co	Will H. Jones	do	do	Repressings	
Gedney Pickling Co	W. C. Stagner & Co	do	do	Mixture, cid. and low wine	
Marshalltown	J. P. Farmer	Sherburn	do	Colored, not cider	Color.
Marshalltown	Sokolik & Bukik	Jackson	do	do	
Ransom Bros	Follett Bros	Sherburn	do	Repressings	
Unknown	Cook & Co	do	Vinegar	Colored low wine	Color.
Unknown	J. F. Ashley	Jackson	do	do	do
Kenney & Robinson	Olsen & Havel	do	Cider	do	
Barrett Pressing Co	C. Lang	Lakefield	do	Combination	
Alden Vinegar Works	Kolash & Walker	do	West India spiced	Glucose vinegar	Def. in acid.
Kenney & Robinson	Unknown	Jackson	Cider	Colored low wine	
Kenney & Robinson	A. E. Olsen	do	do	Combination	
Alden Vinegar Works	W. Searles	Lakefield	Pure old vinegar	Glucose	Def. in acid.
Alden Vinegar Works	Kolash & Walker	do	White wine	White wine	do
Alden Vinegar Works	W. Searles	do	West India spiced	Glucose	do
F. C. Johnson	W. S. Lewis	Worthington	Cider	Cider	do
James Holmes	do	do	do	Colored vinegar	Not cider, col'rd
Reed, Murdock & Co	E. W. Davis	Detroit	do	Colored white wine	Illegal.
Spink & Son	Wannested & Wagenstein	Lake Park	Pure cider	Cider	Def. in acid.
Red X Vinegar Works	H. Rogers	Moorhead	Cider	White wine and cider	
E. M. Rawworth & Co	John Marth	Barnesville	Red wine	Colored white wine	

BAKING POWDER.

Perhaps no article of food or substance entering into the preparation of food, has been forced so prominently before the people as the various brands of baking powder. At no time has the rivalry been so fierce as at present. Our state law only requires the manufacturers of alum, or alum phosphate baking powder to label their cans so that the public may not be deceived in the quality of goods they are purchasing. In many states the sale of such powders is prohibited by law. Notwithstanding our leniency in this matter, it is not unusual to find alum powders labeled in such a manner that it will not be noticed by the purchaser. Almost all such powders are accompanied by a "bluff," as "warranted absolutely pure," $10,000 reward to any person finding a trace of alum, etc.

The first class, or cream of tartar powders, concerns us but little, unless in an advisory way. Their number is legion, contrary to the statement of each individual manufacturer, there is no great difference between them. The conditions determining their value are:

1. Pure and dry material.
2. Proper and thorough mixing.
3. Judicious "filling."

Practically the only difficulty in their manufacture is in mixing the ingredients in the correct proportion. If this is done, as it is perfectly feasible to do with cream of tartar and soda of uniform strength, the value of the powder depends upon the starch "filler." The purpose of the filler is to separate the chemicals, so that they will not combine before wanted, and thus lose strength. Some manufacturers sacrifice a little strength to keeping qualities. 20 per cent. of starch is about the minimum amount that should be present in a powder expected to keep.

In July of the present year there appeared in the advertising supplement of the "Cosmopolitan," an article entitled, "Some Sanitary Aspects of Bread Making," by Cyrus Edson, M. D., Commissioner of Health, New York City. Nominally it is a caution against using yeast raised bread; practically it is an advertisement of a certain baking powder. Indeed, the veil behind which he writes is much too thin to conceal the motive, even to the least observing. Therein he makes some statements which would be surprising from an unprofessional man, astounding from an M. D., and unheard of from a man occupying a position of public trust. For example, he says: "Baking powders are composed of an acid and an alkali which, if properly combined should, when they unite at once destroy themselves and produce carbonic acid gas. A good baking powder does its work while the loaf is in the oven, and having done it *disappears.* The best baking powder made is, as shown by analysis "The Royal." It contains absolutely nothing but cream of tartar and soda, refined to a chemical purity, which when combined under the influence of heat and moisture produce carbonic acid gas, and having done this *disappears.*"

The statements are too ridiculous to require comment.

Only two years ago cream of tartar containing less than six per cent. foreign material was as good as could be obtained at a moderate price. Today it is possible to obtain it in any quantity 99½ pure. This advance in chemical technology should show a corresponding increase in strength and purity of baking powder.

It also necessitates a change in the formula for a perfect powder, calculating from the standpoint of a 100 per cent. cream of tartar, and allowing 20 per cent. for starch filling we derive the formula.

Starch	20.000	per ct.
Cream of tartar	55.296	"
Sodium bi carbonate	24.704	"
	100.000	

This powder should yield 12.949 of available gas. This is dessipated upon heating. There remains in the bread as a further product of the combination.

Starch filler	20	per cent.	
Potassium sodium tartrate	61.76	"	(Rochelle Salt.)
Water	5.30		
Total	87.06		
Carbonic acid gas escaped	12.94		
Total	100.00		

It will be noticed that some of the recorded analyses approach very close to the standard of excellence. One sample is even higher, but that powder does not contain sufficient flour "filler" to hold its strength long in contact with air.

ANALYSES OF BAKING POWDER.

MANUFACTURER.	Name of powder.	Name of seller.	Location.	Total carbonic acid.	Dry alum per cent.	Found to be.	Labeled.
W. S. EBERMAN, Chemist.							
Vouwie Bro.	May Flower	O. A. Dalger	Austin	8.42	15.47	Alum powder.	No.
McNeil & Higgins	New Chicago	A. Nussel	Springfield	9.12	15.76	Alum phosphate	No.
J. G. Flint	White Rose	McCarthy & Reddy	Brainerd	8.94	14.71	Alum phosphate	No.
Zep & Schowndoffer	Eclipse	O. L. Foseth	Underwood	4.86	16.42	Alum phosphate	No.
By DREW, Chemist							
Spa B. P. Co.	"Spa"	R. Westhoff	Mankato	....	....	Alum phosphate	No.
E. N. EATON, Chemist.							
American Soda Works	Old Abe	Fellows & Metcalf	Minneapolis	10.83	....	Cream tartar	....
Chas. F. Glockner	Bee Hive	J. M. Dodson & Co.	Minneapolis	10.04	....	Cream tartar	....
Yerxa Bros	Yerxa Extra	Yerxa Bros	Minneapolis	10.85	....	Cream tartar	....
Columbian Coffee Co.	Regal	Geo. Ballhüm	....	11.21	....	Cream tartar	....
Mariam Collins & Co.	Imperial	A. Torgeson	Adams	9.40	26.68	Alum phosphate	No.
Calumet Baking Powder Co.	Calumet	Bergen & Patten	Graceville	11.37	25.31	Alum phosphate	No.
Calumet Baking Powder Co.	Calumet	Wolf Bros	Appleton	11.37	25.31	Alum phosphate	No.
Park & Nelson	P & N	Unknown	....	12.70	....	Pure cream tar.	....
Capital City Pharmacy	Capital	St. Paul	....	13.47	....	Pure cream tar.	....
Unknown	Pure	St. Paul	....	11.93	....	Pure cream tar.	....

PRESERVATIVES.

Almost every article of food, the manufacture or sale of which is regulated by our state law is liable to contain poisonous preservatives. Milk, butter, eggs, liquors, fruits, canned goods, meat all have been found to contain chemical antiseptics of a poisonous nature.

As sensitive as are the public in matters touching their pocket book, they do not so greatly object to being swindled, or to pay the price of a superior article for inferior goods; but every thinking man does object to those forms of deleterious adulteration, depending upon the use of added preservatives. Many will agree with Dr. Hehner, ex-president of the English society of public analysts, who in an address before the society said:

> "We should work for the entire prohibition of all kinds of preservatives. It is time that we went back to natural food. I object to being physicked indiscriminately by persons not qualified to administer medicine whilst I am in health. I object still more when I am ill. I object still more stongly to have my children physicked in their milk or their bread and butter. It is no consolation to me to know that the physic is not immediately fatal, or not even violently injurious. The practice is utterly unjustifiable, except from the point of view of a dealer who wants to make an extra profit, who wants to palm off a stale or ill-prepared article upon the public."

It is the usual order of organic material to decay. Whether it be a beautiful flower or noxious weed, necessary to comfort or injurious to health, valuable as a fuel or food, in time it must yield its elements to the air. In a former age when man's needs were few, and the means of satiation abundant, the necessity for preserving food for any length of time was not as great as at present, when the densely populated and pampered people demand the choicest of food, in season and out of season, whether it grows in their own temperate zone, or in the torrid orient.

As one locality produces food in much larger quantities than is needed for home consumption, it is but natural that the enterprising Nineteenth Century should find some means to retard decomposition until an exchange of commodities can be made. One of the first facts discovered was that it is not natural for most food products in themselves to decompose, but that such decomposition is effected by living organisms, bacteria. To bar their entrance, to retard their growth, or to entirely destroy these bacteria is the aim of the producer. This may be accomplished in a number of ways, many of which are harmless. The methods of food preservation may be classified under four heads.

1. Drying.
2. Exclusion of air.
3. Low temperature.
4. Chemical antiseptics.

There can be no objection to drying or elimination of the major part of the water. This form of preservation is extensively used in fruits, raisins, beef extract, condensed milk, soup, etc. The new method of drying in vacuo has greatly enhansed the value of such articles.

The exclusion of air is known to every house-wife as one of the best methods of preservation. The effectiveness of this method is perhaps more forcibly shown when the jar of preserves has not been sealed perfectly tight. The success of the process is always dependent upon the destruction of micro-organisms already in the article to be preserved. When applied to alcoholic beverages, this process is called "pasteurization." For want of a better term, the same name has been applied to milk when decomposition is arrested by heat.

Refrigeration is extensively used in keeping all articles of food for a short time. This is one of the most valuable methods, as articles preserved in this way are wholesome and preserve their natural color, form and flavor.

With these harmless methods of preservation, applicable to almost every article of food, it would seem that no other means would be employed. But there are some defects in the mentioned methods; some are expensive, some will not preserve indefinitely, all are effective only as the conditions are rigidly observed. To overcome these difficulties and also to preserve articles of food too far decomposed to allow of other treatment, chemical agents are added which destroy the micro-organisms and prevent the growth and development of the spores. Among the chemical agents so used may be mentioned, alcohol, acetic acid (vinegar), salt, sugar, sulphuric acid, sulphurous acid, salicylic acid, borax, boracic acid, benzoic acid, sodium benzoate, sulphite of potassium and sodium and lime, bisulphite of potassium and sodium and lime, naphthol, saccharin.

Many other chemicals as arsenic, corrosive sublimate, etc., are excellent antiseptics but too violently poisonous to be thought of as preservatives for food. The first four named are certainly harmless, but must be used in large quantities to be effective. The consensus of opinion at present is that the remainder are one and all harmful. They are powerful as therapeutic agents and cannot be inactive in food. If the antiseptics are successful in preventing growth and activity of the micro-organisims in the food, they cannot be inactive towards the digestive fluids whose functions are dependent upon similar ferments. Let me suggest that this class of food preservatives receive a more general condemnation by those concerned in the public health.

The powder "preservaline" was found to consist largely of sodium benzoate.

A package of the "Great French Preserving Process" was purchased of Bannon & Co,, St. Paul, agents, Snodd, Savage & Co., St. Paul. Among the claims made by the manufacturers is that it preserves all kinds of fruit, vegetables and berries in their natural state; no cooking, no sugar, no air tight cans, no *acid*, no alcohol used. Certain so-called physicians and chemists go on record as claiming that it "contains absolutely nothing injurious to the health of persons eating fruits, etc. preserved by its use," that "there is nothing harmful in its use, but on the contrary the process is conducive to the health where used."

These soft and soothing words undoubtedly mislead many people.

The manager of Wildwood writes the agents that he wishes to be supplied with 100 cases of strawberries, etc., put up by the great French preserving process.

The "process" depends for its effectiveness upon the powerful agent sulphurous acid. The powder is simply a mixture of sulphur, charcoal and salt-petre, the ingredients of gunpowder. Instead of mixing the ingredients in the proportion to form an explosive mixture, they are mixed so that the sulphur may burn slowly forming sulphurous anhydride, which is absorbed by the water forming sulphurous acid. The preservative it may suffice to say will perform its work perfectly, except that it is a great bleaching agent, and destroys the color of the fruit. Its use is entirely prohibited in most of the countries of Europe.

APPENDA,

The average water content of butter and the water content of butter considered the best by competent judges is always a matter of interest and value. The Danish and English have already taken steps to regulate the percentage of water and fat in butter. The Prussian minister of agriculture has lately requested the agricultural experiment stations to make extensive studies on the percentage of water in butter at different seasons of the year, with a view to fixing the maximum for the water content of butter. The percentage of salt and casein held in good butter, should be the ideal to which the butter maker should strive.

Through the courtesy of Mr. J. L. McKinstry of Minnesota, and Mr. G. L. Gabrielson of Iowa, samples of premium columbian fair butter made in Minnesota and Iowa were procured. It was thought that the chemical composition of such butter might be of interest in the points already mentioned, and that possibly such analyses might throw more light upon the relation of chemical constitution to commercial quality of butter. If of no value in themselves, it is hoped that in conjunction with other and future analyses, there may be some way of judging the quality of butter by the chemical analysis.

As an aid in studying the results the following analyses of premium butter from other sources are recorded.

At the Connecticut experiment station, 11 samples of private dairy and 6 samples of creamery butter were analyzed.

	CREAMERY.		PRIVATE DAIRY.	
	Range of compositi'n.	Average compositi'n.	Range of composit'n	Average composit'n
Water	6.5-11.4	9.1	8.6-12.7	10.8
Fat	84.3-88.4	86.9	80.7-87.7	83.9
Curd	.9- 1.6	1.1	.9- 2.5	1.5
Ash	2.1- 4.0	2.9	1.2- 7.8	3.8

The private dairy butter which received the lowest grading for flavor, grain and salt, were ones which had the very abnormal high per cents. of salt (6.78 and 7.83).

The creamery butter, as a rule, carried three per cent. more of actual butter fat than the private dairy.

The premium butter at the American Dairy show, held in Chicago in 1889, was analyzed with the following result:

No.	Description.	* Rat'g	† Water.	Fat.	Curd.	‡Ash.
1	Sweepstakes, creamery, gathered cream.	96.	9.99	85.41	1.01	3.58
2	Sweepstakes, creamery, whole milk......	94.	12.19	82.66	1.21	3.93
3	Sweepstakes, dairy	93.	8.49	86.53	.86	4.12
4	Sweepstakes, butter from grade cow......	95.5	9.71	85.96	1.03	3.29
5	First prize, buttor from Jersey cow	91.	8.99	88.08	.79	3.13
6	First prize, butter from Shorthorn cow..	91.	12.07	84.79	1.34	1.79
7	First prize, butter from Ayrshire cow....	93.	9.53	86.53	.81	3.32
8	First prize, butter from Devon cow	87.	10.78	86.20	.72	2.29
9	First prize, butter from Holstein cow....	92.5	10.56	85.53	.88	3.03
	Average..............................	92.5	10.23	85.74	.96	3.05

*The standard of the scale of points in the total of 100 was: Flavor, 45; grain, 30; color, 15; salting, 10.

†The per cent. for water may be somewhat low, due to loss by evaporation while on exhibition.

‡Chiefly salt.

The three butters showing the lowest rating in salting were also lowest in the total rating and contained the smallest amount of salt.

The following analysis represents the product of a separator factory, the butter sampled directly as made: Water, 14.12; fat, 80.63; curd, 1.20; ash, 4.05. Butter from this factory would, as a rule, not vary much from the representative analysis. It is recorded more especially on account of the unusually high percentage of water.

The samples of Columbian fair premium butter were received in the laboratory in tight stopped glass bottles. Some of the water had separated out, otherwise the samples were in good condition, fresh and of good flavor. The sample for analysis was prepared as recommended by the association of official agriculturist chemists (Bulletin 35,) and an homogeneous sample secured. The method of analysis was essentially that adopted by the A. of O. A. C. Each determination was made in duplicate.

ANALYSIS.

No.	DESCRIPTION.	Water.	Fat.	Curd.	In Sol. Ash	Salt.	Sp. Grav.	Absorption cap.for401c for sodium	Reichert VollinyNo
3138	Separator, 96 points....	8.50	87.35	1.15	.10	2.89	.9099	....	26.20
3114	Gathered cream, Ia,94 p	9.05	87.77	.93	.10	2.14	.9100	37.4	25.45
2899	Gathered cream, Minn.	11.68	84.04	1.05	.08	3.17	.9096	37.7	26.20
H	1st Dairy, Minn.........	11.37	84.39	.81	.05	3.40	.9097	....	27.75
3141	Set Milk, Ia............	8.80	88.03	1.07	.08	2.26	.9098	37.7	27.75
......	Average..............	9.88	86.11	1.00	.08	2.77	.9098	37.6	26.67

The two samples of butter from Minnesota, are lower in fat and higher in water and ash than the samples from Iowa. There appears no consistent difference between the various kinds and grades of butter.

This conclusion is in line with Whitcher, who remarks that he finds that something more than a chemical analysis is required to determine the marketable quality of butter. So it must be concluded that although unquestionably creamery butter is becoming more uniform in quality, the time has not yet arrived when we can *distinguish* by a chemical analysis the best grades of creamery and dairy butter. A chemical analysis of much of the butter on the *market* will give a fair index to the manner of manufacture.

In comparing the analyses of the premium butter in 1889 and 1893, it will be noticed that the agreement in percentage of water, fat, curd and salt is remarkably close. The salt is a trifle less and this is singular, as even 3.00 per cent. is less than usually found in the butter on the market. The salt of butter is as far as possible in solution in the water present, and in well-made butter should not exceed a saturated solution of salt in the water present. In old butter from which water has evaporated it may be noticed that salt crystalizes out, yet, in a different form or mode (needles) from that usually exhibited (cubes). As the amount of fat in butter is almost entirely dependent on the water content the determination of water or total solids is the most valuable determination in the analysis of butter. Much, and it may almost be said most of the butter produced will be found to contain over 10 per cent. of water. 85 per cent. of Danish export butter is said to contain between 13 and 16 per cent, of water. The analysis of the premium Columbian Fair butter confirms the results heretofore obtained, that the best butter is not "adulterated" with water, indeed nearly exceeds 12 per cent.

The Riechert Vollny figure for volatile soluble acids is singularly low. It would certainly be desirable that this determination be made upon other high grade butter as it is nearest related to the chief characteristic upon which butter is graded —flavor.

CHEESE FACTORIES.

Herewith is the report of work done in the cheese factories of the state by inspector E. B. Williams, which will give those interested an idea of the importance of this branch of dairying.

During the year past, I have inspected milk and cheese in about 100 cheese factories and creameries. I have tested each sample of milk by the Babcock test, having made in all about 1,500 tests. The result of my inspection in the various factories was carefully noted, and a full report of each day's work sent to the secretary of the department. When desired, instruction was given to cheese makers and also to patrons regarding the care of milk. In comparison with other years, a marked improvement was found in the quality of cheese. The largest percentage of cheese produced in this state is made on the Cheddar plan, which I will consider further on in this report.

It is a satisfaction to report that we do not as formerly come in contact with the soft, spongy, ill flavored and generally bad appearing cheese. That is not the kind of cheese which our factories are engaged in making. My duties have also called me to the inspection of milk which is sold in towns throughout the state. The milk delivered at cheese factories I found generally to be above the standard. There were instances where suspicion rested pretty heavily, and in those cases, the samples were sent to the department for chemical analysis. In my special line of work as cheese inspector, I also visited grocery stores and examined cheese kept by grocerymen for sale. If I had reason to doubt the quality of cheese kept by them, I at once secured samples and sent them in to the department for analysis.

Another matter which ought not here to go unnoticed, was the fact that all milk delivered at stations to be shipped to the cities was also inspected. Many letters coming from factory men wishing to employ butter or cheese makers, I have received and answered. Also letters coming from butter and cheese makers who were seeking employment. They each received the same considerate and courteous attention. As an index of the work which is being carried on, and to show the magnitude of the cheese industry which is, I am glad to say, constantly growing, I here append a list of the cheese factories of the state with such data as I consider of interest and importance to the readers of this report.

Many of the factories in the state have not yet closed up their season's work. Therefore, from these factories reports could not at this time be obtained. There were others just closing but owing to other matters pressing them, their reports could not be secured in time to be placed in the list before this report went to press. From the following report and other reliable information, I calculate the total amount of cheese produced this year in Minnesota to be approximately 2,500,000 lbs.

The man who is to make a success of the production of cheese, need not content himself with the thought that he is traveling a royal road. By no means can he sit down in sloth and idleness and court prosperity. She is one of those wily elfs that must be won over by toil, skill, patience and economy. It is largely experimental work in which the cheese maker is engaged. Each day he may find new conditions, and it is his business to meet these conditions, to study them and to overcome them. If he does not, he sooner or later finds that he has a "soft," cheese, a "spongy" cheese, a "hard" cheese, or perhaps worst of all, an ill-flavored cheese which nobody wants at any price.

At this point I wish to emphasize some facts regarding the making and curing of cheese; facts I have gained only by close observation and a practical experience in field and factory covering a period of over twenty-five years. As milk is the foundation of all cheese, the quality of the cheese cannot be good unless the milk is good. It should be rich milk. Four per cent. of fat, five per cent. or even six per cent. is none too good for cheese. It is claimed by some who desire a half cream or a skim cheese, that all the butter fat above four per cent. is lost in the whey. Experiments and facts do not bear out these assertions. Take New York for an example. The experiments at the New York Experiment Station are interesting. These experiments showed that the actual amount as well as the proportion of milk fat lost in the whey increased gradually, but not uniformly when the amount of the fat in the milk increased, but while it was true that the loss of the fat increased both absolutely and relatively, when the amount of fat in the milk increased, it was not true that all the additional fat above four per cent., or even about five and one-half per cent. was lost in the whey. Results similar to those just stated have been obtained with cheese at our own experiment station.

Now let us return to the milk. The receiving of the milk at the factory is an item of prime importance. The utmost care should be exercised in the receiving of milk. These are some of the essential points to be considered.

In the first place if you have sour milk or over-ripe milk, it means fast heating. Second; this sudden heating requires quick handling of the curd to get an even distribution of heat throughout the entire mass while scalding to the right temperature. The factory man should insist on his patrons exercising the utmost care with their milk. It is always better for the maker to ripen his own milk to the proper degree of acidity. Another point to be considered: The maker should examine all cans, covers and seams in cans once or twice a week to thoroughly satisfy himself that all patrons keep their cans properly cleansed. As a reminder to both the maker and patron I wish here to repeat what Prof. James Robertson of Canada, has already said. When a man in a cheese factory has a can all greasy inside and all spattered outside, he is not ready to seek skill. He is going to contaminate the milk, and skill and contamination won't go into partnership in the dairy business. So my advice to the patron is to see that as soon as the cans are brought home, they are at once emptied and washed with warm water, then scalded with boling water and sufficiently aired during the day to keep sweet.

Throughout the United States and Canada where the Cheddar or the "stirred curd" cheese is made, there is but little variation in the process of making. In the manufacture of the above varieties the milk is generally heated to a temperature of about 85 degrees Fahr., a slightly higher or lower temperature used according to the judgment of the maker, as peculiar conditions may demand. The ripening is an essential feature, and for the purpose of obtaining the desired degree of acidity, various tests are brought into requisition. The principal ones being the Boyd test, the Monrad and the system quite generally used throughout Canada known as the cup test. The latter is a good practical test for the degree of acidity or ripeness for cheese making.

The method is applied in the following manner: After the vat of milk has been heated to the desired temperature, take eight ounces of milk from the vat, a tea cup or some small dish to manipulate the test in and one drachm of rennet extract of known strength diluted with a drachm of water just before adding the rennet, take your watch in one hand and a tea spoon containing the rennet in the other and when the second hand of your watch comes to some known number drop the rennet into the vessel, thoroughly stirring with a rotary motion for 10 or 12 seconds. To be able to tell for a certainty when the milk in the cup has begun to coagulate put a small piece of burnt match or scale board, or something that will float, in the cup or vessel just before the rennet extract is added. By constant stirring, the black speck is put in motion with the milk; when it suddenly stops the milk has begun to coagulate. If the milk coagulates in from 25 to 30 seconds it is ready to set. The exact degree of ripeness is something hard to determine but the intuition of the skilled cheese maker enables him to tell the proper point. It is generally understood that the object in the ripening of the milk before adding the rennet is to render the action of the rennet more rapid. There is little doubt but that the ripening has some other influence. The bacteria, for instance, thus added in the form of a "starter," tends to develop in the cheese a high flavor, similar to that of ripening cream for butter. There are many things regarding the influence the ripening of milk has upon the process of cheese making or upon the finished product, which we do not yet fully understand. This fact we are aware of: The rennet may cause the milk if properly ripened to coagulate in 10 or 20 minutes, whereas, if added to milk that has not been ripened, the rennet may not cause proper thickening of the milk short of two hours. Another important fact to be considered in the making of cheese. The judgment of the cheese maker must be called into action in order to determine when the curd is firm enough to cut and yet not too firm.

The next step, as soon as the curd is sufficiently cut, is to stir very gently for 10 or 15 minutes until the outside of the pieces of curd show the appearance of a slight film and the whey commences to separate freely from the curd. The curd is then heated gradually to a temperature of about 98 degrees F. The rapidity of heating and the extent of heating are points which the judgment of the maker can alone determine. During the heating the curd is kept in constant but gentle agitation. This heating causes each piece of curd to shrink and expel moisture whereby it becomes more firm and dry. Relative to the details of this shrinking and drying action, much remains to be learned, but it is probably due to the combined action of heat, of rennet and of lactic acid. After the temperature has reached about 97 degrees F. the heating is discontinued and the curd is stirred only at intervals sufficient to prevent its packing on the bottom of the vat. When the curd has become sufficiently firm and dry, it is allowed to settle and the whey is drawn off. To tell exactly when is the proper time to draw the whey from the curd requires the very best judgment of the maker, for this is one of the most critical points in the manufacturing of cheese. Here must be brought into requisition the cultivated sense of smell, touch, taste and sight.

For the hot iron test take a piece of iron about two feet long, heat it hot, but not enough to scorch the curd. Take a handful of curd from the vat. squeeze out the whey, press it against the iron, and if it adheres to it and on removing strings out in fine threads like hairs, the acid is developed and all whey should be removed. The curd should be allowed to stay in the whey until it will string on the hot iron from one-eighth to one-fourth of an inch. The maker should be careful not to allow too much acid to develop in the vat before the whey is removed.

While we have a variety of cheese made in this state, of which I may here mention Cheddar, Stilton, "stirred curd," Neufchatel, Sage, Switzer, Brick and Pineapple, I will notice in particular the Cheddar. It is a popular cheese and made on this plan: After the whey has been drained from the curd, the curd is packed on opposite sides of the vat, leaving a space in the centre to enable the whey to drain off more readily. After a time the curd becomes packed or matted and is cut in pieces to such size as may be convenient to handle. These pieces are turned over from time to time to allow the whey to drain more rapidly. When the curd has become pretty well freed from whey, the pieces are doubled, and the process of doubling is continued at short intervals until the whole forms a compact pile. It is then held at a certain temperature until it assumes a certain condition which the eyes and also the touch of the skilled maker can detect. The curd is then turned up, spread out and cooled at about 85 degrees F. It is now ready to run through the curd mill. After being cut completely, the curd is salted and put to press. From time to time our attention is called to certain rules and regulations laid down by those who are supposed to be authority on the making, curing and handling of cheese. A few of these rules are essential and no cheese maker can afford to ignore that which brings success to his calling. It is with this object in view that I have reproduced some of the excellent suggestions offered by Prof. James W. Robertson, dairy commissioner of Canada: The notes which refer particularly to the opening of the spring's work, which usually begins in May, are to the point and as follows: If there be a leakage anywhere from the floors, spout or tanks, which is not immediately preventable, provision should be made for the drainage of the waste if only by shallow open trenches. A liberal supply of lime and gypsum should be spread around such places. Don't fail to secure a barrel or two of each for use during hot weather. If the factory buildings are not painted and will not be painted get them whitewashed this month. Make the surroundings of the factory neat and tidy. Plant a few trees. While keeping the outside of the premises as creditable to your tastes and neat habits as possible, make the inside to reflect still more your aversion to everything untidy and dirty. Give every part of the factory a thorough cleaning and keep it in a sweet state all summer.

Before the curing room contains any cheese, fumigate it by burning some sulphur mixed in alcohol. That will help to prevent the growth of mould on the outside of the cheese. Be sure that the making room floor is so well constructed and supported that it will not shake or vibrate during the coagulation of the milk. There are other points about a factory which no cheese maker can afford to overlook. For instance, the hoops should be evenly filled so as to have the cheese of uniform size. Light pressure should be applied at first, gradually increasing it every ten minutes for from half to three-quarters of an hour, allowing the cheese to gradually knit together which will give a closer body than if hard pressure is applied at once. After proper pressing, the cheese should be taken out, the bandages should be pulled up carefully and neatly folded over the ends, allowing about one inch to lap over the ends, then put to press again and more pressure applied. The last thing at night, apply all the pressure you can; then in the morning, the first thing apply still more. Do not think that when your cheese is taken out of the press that the work is all done. The ripening process must now begin, and one of the principal things is to keep an even temperature in the curing room. The peculiar mellow appearance and fine texture of good cheese may be, and is due to a certain extent to the butter fat, nevertheless, these qualities largely depend in a much greater degree upon a gradual change to which the caseine is subjected in ripening.

A cheese that is properly made with uniform ripening, will, other things being equal, have that rich oily body, also that peculiar flavor so much desired and appreciated by the masses who eat cheese. Everything in the curing room should be in perfect order. See to it that the cheese be carefully rubbed and turned on the shelves every day. If when put in the curing room the head cloths are not left on; they should be immediately greased with hot grease to prevent them from cracking. In preparing cheese for market they should be carefully weighed and boxed, using scale boards on each end, and the weights should be plainly marked on the box. Boxes should be shaved down to within a quarter of an inch of the cheese.

When we take into consideration the superior advantages which we as a cheese producing state possess, there is no reason for being in the least discouraged. Our climate is excellent for stock; we have the best of grasses, and are able to produce any kind of forage necessary. No state in the Union has a purer or better water supply, and the dairymen are fast improving their breeds and their herds of dairy cows. In the enactment of proper laws for the encouragement of the dairymen and the farmer, and for the protection of the consumer, no state has gone farther or been more jealous of the rights of her citizens. The wisdom of having a standard fixed by our legislature for cheese none will attempt to dispute. Many states desire a law similar to ours, but their efforts thus far in that direction have not proved successful. In their report of 1892, the Massachusetts State Board of Health pointed out the advantage to be gained by having a state standard for cheese, but their state has not yet succeeded in enacting a law of that character.

With all the advantages bequeathed us by nature; the enactment of good dairy laws; the streneous efforts made for the enforcement of those laws, and the fact that at the dairy exhibit at the Peter Cooper Institute in 1875, Minnesota carried away the prizes, still we have to deplore the fact that at our Columbian Exhibition in 1893, Minnesota had practically no part nor lot in the way of exhibiting her great and growing cheese industry.

What where we doing, that we should have let slip this grand opportunity of our lives never to come again, perhaps, to show to the world our resources as a cheese producing state?

CHEESE FACTORIES.

Number.	LOCATION.	Daily Capacity.	No. of cows from which milk is bought.	Average quantity daily in lbs. received.	No. of months operated.	Average price paid per 100 lbs.	Kind of cheese made.	Total amount manufactured.	Average yield of cheese per 100 pounds.	Co-operative or company.	Where marketed.	Average price received.	Proprietor or manager.
1	Fergus Falls	20,000	350	......	6½	.85	Chedder	66,000	9.94	Co-operative	North and West	.10¼	W. L. Chappel.
2	Olmsted	20,000	500	......	4	.80	do	75,500	9.80	Company	West	....	Crescent Creamery Co.
3	Byron	20,000	900	......	6	.80	Twins	175,000	9.78	do	do	....	do do
5	Berne	20,000	......	......	5	.80	do	109,500	9.70	do	do	......	do do
18	Rock Dell	10,000	256	3,326	7	.72½	Full cream	61.583	10.00	do	Home	.9¾	Marcus Wing.
20	Austin	5.000	160	3,200	5	......	Cheddar	2,800	9.00	do	do	.10	A. P. McBride.
21	Lansing	6,000	......	2,100	4	.....	do	21,000	9.40	do	do	.10	H. M. McIntyre.
26	Medford	20,00	......	......	6	......	do	140,800	9.87	do	East and West	.....	Crescent Creamery Co.
30	Le Roy	2,000	80	......	6	......	Swiss	18,000	10.00	Individual	Chicago	......	John Frank.
33	New Richland	10,000	300	3,982	5	......	Full cream	41,473	9.⅞	Co-operative	Albert Lea	.08	H. Jaehing.
41	Havana	15,000	325	3,000	12	.88	do	86,400	10.25	do	West	.10½	L. A. Disbrow.
47	Frazee	6,000	40	600	5	75	do	7,134	9.50	do	Local	.10¼	Wm. G. Chilton.
62	Pine Island	20,000	......	......	5	......	do	76,500	9.95	Company	....	......	Crescent Creamery Co.
105	Villard	2,000	125	535	5	.70	Twins	6,735	10.50	do	Home	.10¼	O. B. Butler.
112	North Redwood	4,000	80	1,000	6	.75	do	10,500	10.50	Private	do	.10½	C. Fleischer.
118	Sumpter	15,000	......	2,575	12	.87	Full cream	88.944	......	Co-operative	do	......	
120	Acoma	9,000	300	4,000	5	.80	Twins	43,049	10.00	do	St. Paul	.10	C. E. Hill.
125	Alma City	7,000	300	2,000	5	.70	Full cream	24,000	9.⅞	Private	Home	.10	A. E. Comstock.
133	Union Hill	20,000	100	1,500	6	.65	Twins	20,000	9.50	do	Minneapolis	.09	M. T. Schmitz.
136	New Rome	4,800	75	1,063	5	.70	Full cream	9,000	9.25	Company	Home	.11	G. Marthevig.
138	Lansing	5,000	100	1,500	7	.70	Brick	27,930	9.00	do	Minneapolis	.10	F. Schuett.
140	Eagle Lake	300	74	800	7	.72½	Full cream	5,800	9.75	do	Mankato	.9½	S. V. Perry.
141	Cedar Mills	12,000	150	1,400	8	.85	do	29,404	10.00	Co-operative	Minneapolis	.10	C. G. McEwen.
149	Minnesota Lake	2,500	85	1,500	1	.65	Brick	18,500	10.00	Company	Mankato	.10	P. F. Wendt.
151	Spring Valley	1,000	24	1,000	6	.80	Full cream	6,000	10.00	do	Home	10½	A. DuMey.
160	St. Michael's Station	600	168	1,830	5	.70	do	23,545	10.11	Co-operative	Mina	.10	E. D. Washburn.
...	Ashby	5,000	......	1,800	6	.70	do	2,000	10.00	do	Local	......	G. Hoff.
....	Appleton	10,000	......	1,300	5	.60	do	6,000	10.00	do	do	......	P. M. Scott.
*22	Hector	5,000	......	......	4	.80	do	4,000	9.75	do	do	......	W. B. Strom.
*13	Good Thunder	2,500	75	2,500	8	.75	Brick	15.000	9 00	Company	East	.12	G. B. Manther.
*93	Owatonna	2,000	300	1,300	4	.90	Full cream	2,000	10.00	Co-operative	Minneapolis.	.9	Geo. B. Barker.
*95	Hampton	2,000	.....	2,500	5	.65	Cheddar	14,850	10.00	do	St. Paul	.10	J. Iosfeler.
*97	Biscay	25,000	870	8,600	12	.90	do	205,306	......	do	do	......	Carl Hagen.
*110	Stanton	10,000	1,100	540	7	.75	do	113,479	9.50	do	White Rock	.9	E. O. Imberg.

The following is the honey law passed at the last session of the legislature, and is a law that was much needed in order to encourage the production of pure honey in this state. Unprincipled dealers have heretofore taken advantage of the lack of suitable laws of this character, and have imported or manufactured the adulterated article, and placed the same on sale on our markets, much to the detriment of the honest product. If there is any comfort for the dealers of the spurious product in this law, they are entirely welcome to it. The dairy and food department in whose hands it is placed for enforcement will see that its provisions are fully carried out, and they are busily engaged at the present time analyzing numerous samples taken from our markets.

CHAPTER 21, GEN. LAWS OF MINNESOTA FOR THE YEAR 1893.

AN ACT IN RELATION TO THE SALE OF HONEY COMPOUNDED OR ADULTERATED, AND TO PREVENT FRAUD AND TO PRESERVE THE PUBLIC HEALTH.

Be it Enacted by the Legislature of the State of Minnesota:

SECTION 1. It shall be unlawful for any person or persons within the state of Minnesota, to offer for sale or have in their possession with intent to sell, sell or cause to be sold, honey compounded, manufactured from, or mixed with glucose, sugar syrup of any kind, or any substance whatever, not the legitimate and exclusive product of the honey-bee, unless the package containing the same is so marked and represented as such, and bearing the label upon the package, printed thereon in heavy gothic capitals eighteen point, the name of the person or persons having compounded or mixed the same, and the name of the substance or material from which it is compounded, manufactured or mixed with.

SEC. 2. It shall be unlawful for any person or persons within the state of Minnesota, to offer, or have in their possession for sale, sell or cause to be sold honey which has not been made by the bees from the natural secretion of flowers and plants, but which has been stored or made by the bees from glucose, sugar syrup or any other material or substance fed to them; unless the same is marked, represented and designated as such, and bearing a label upon each package printed in heavy gothic capitals eighteen point thereon, the name of the person or persons who fed, or caused to be fed, the substance or material from which the same is stored or made, and the name of the substance or material from which the said honey is stored or made.

SEC. 3. Any person or persons violating sections one and two of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof be punished for each offense by a fine of not less than fifteen dollars or more than one hundred dollars or by imprisonment in the county jail not exceeding thirty days, or both such fine and imprisonment

SEC. 4. The having in possession by any person or persons or firm any honey compounded, manufactured or mixed as hereinbefore described, or any honey stored or made by the bees as hereinbefore described, and not labeled as provided in this act, shall be considered prima facie evidence that the same is kept in violation of the provisions of this act.

SEC. 5. It shall be the duty of the state dairy and food commissioner and his assistants, experts, chemists and agents by him appointed, to enforce the provisions of this act.

SEC. 6. The said commissioner, and his assistants, experts, chemists, and others by him appointed, shall have access, ingress and egress to all places of business and buildings where the same is kept for sale. They shall also have power and authority to open any package, car or vessel containing such articles which may be manufactured, sold or exposed for sale in violation of the provisions of this act, and may inspect the contents therein, and take samples therefrom for analysis. All clerks, bookkeepers, express agents, railroad agents or officials, employes or common carriers or other persons shall render them all the assistance in their power, when so requested, in tracing, finding or discovering the presence of any prohibited article named in this act. Any refusal or neglect on the part of such clerk, bookkeeper, express agent, railroad agents, employes or common carriers to render such friendly aid, shall be deemed a misdemeanor and be punished by a fine of not less than twenty-five dollars for each and every offense.

SEC. 7. In all prosecutions under this act the costs thereof shall be paid in the manner now provided by law, and such fine shall be paid into the state treasury.

SEC. 8. All acts and parts of acts inconsistent with this act are hereby repealed.

SEC. 9. This act shall take effect and be in force from and after its passage.

Approved April 17, 1893.

REPORT OF FIRST ASSISTANT DIARY AND FOOD COMMISSIONER.

Hon. Berndt Anderson, Dairy and Food Commissioner:

SIR: My appointment as First Assistant Dairy and Food Commissioner, took effect January 27th, 1893; and being assigned the supervision of the creamery department of this commission, I beg leave to make the following report:

The law under which we operate contemplates that this department shall superintend the production, transportation, manufacture, and sale of all products of the dairy; and that we may visit all places of production, transportation, manufacture or sale, and may make inspection of all such products for the purpose of ascertaining if they are clean, healthful, unadulterated, and wholesome. To carry out such a provision to the letter, would require an army of inspectors and an enormous outlay of money. With these facts in view, I have endeavored to make as complete an inspection as possible with limited time and expense, and have therefore confined my work of inspection especially to the creameries where butter is manufactured.

I have visited during the summer 152 creameries and 21 skim stations, with the following purposes in view.

1. To locate the factory, ascertain plan of conducting and process used, amount and quality of butter produced, the address of managers and makers, number of patrons, and conditions of the dairy interests of such places.
2. To ascertain the sanitary condition of the factory, and that the patrons delivered clean, wholesome milk in clean cans, and that the same was unadulterated.
3. To give such advice and assistance as I found them in need of, relative to the proportionate payment of the patrons and the manufacture of the best products, to the end that the factory produce the most wholesome product possible, and with profit to the producer, so that he can afford to, and will produce and deliver a clean, healthful, wholesome product for the factory.

As to the first of these objects I submit the following table, showing a list of creameries in Minnesota operated in 1893, their location, process used, organization, manager's address, No. of months operated, amount of business done and present prospects.

TABLE I.—Report of Creameries in Minnesota, 1893.

Counties.	Post Office.	No. patrons.	Process.	Organization.	Proprietors or Secretary.	No. mos. oper'd.	Prospects.	Remarks.
Anoka	Anoka	150	Gather cream	Stock Co.	F. F. Pratt	12†	Fair	
Becker	Lake Park	170	do	Private	Wannestad&Wangensteen	12†	Good	
	do	172	do	do	J. Danielson	12†	do	
Blue Earth	St. Clair	204	do	do	Grigun & Coughunour	12§	do	
	Mapleton	100	do	do	G. Spaulding	6*	Poor	
	Good Thunder	40	2 separators	do	Sohn & Hankel	8†	Fair	
Benton	Foley	70	Gather cream	Corporation	E. G. Potter	6†	do	
Brown	Madelia	97	2 separators	Co-oper'tive	John Moe	12‡	Ex. good	Hanska Cr.
	St. James	107	2 sep., both	do	E. Nelson	12‡	Good	Nelson & Albion.
	New Ulm	325	Gather cream	Private	H. Crone	10§	Fair	Very large make.
Carver	Cologne	80	1 sep., both	Corporation	E. G. Potter	6†	do	
	Young America	52	1 sep., both	do	E. G. Potter	12*	do	
Chisago	Rush City	63	1 sep., both	Private	R. Rogers	12†	Good	
Clay	Hitterdal	80	Gather cream	do	W. J. R. Herrick	3†	Poor	
	Hawley	106	Gather cream	do	Johnson & Berg	12‡	Good	
	Moorhead	50	Gather cream	do	O. S. Hadland	8*	Fair	
Dodge	Dodge Centre	225	2 sep., both	do	A. Webster	12‡	do	
	Oslo	420	Gather cream	Co-oper'tive	B. O. Roe	12§	Ex. good	Very large make.
	Mantorville	141	1 sep., both	do	F. W. Van Orum	10†	Good	Burned, re-b'ilding
	Claremont	50	1 sep., both	Private	L. A. Drisbrow	12†	do	
	Byron	120	4 separators	Co-oper'tive	J. R. Webb		do	Building
	Wasioja	300	2 sep., both	do		10§	do	Re-organized.
Douglas	Brandon	63	Gather cream	Private	B. T. Teigen	6*	Poor	
	Evansville	80	do	do	H. C. Halverson	7†	do	
	Osakis	100	do	Stock Co.	F. A. Ranney	12†	Fair	
Faribault	Blue Earth	235	1 separator	Private	Leveneck Bros.	7‡	Good	
	Dayton		Separator	Co-oper'tive			do	Building.
	Easton	150	Gather cream	do	Zienner & Rath	7†	Poor	
	Elmore		Separator	do			Good	Building.
	do		do	do			do	Building.
	Wells	52	1 separator	do	B. Bieri	7†	do	New.
	Delevan	125	Gather cream	Private	Holter & Thies	7†	Poor	
	Minnesota Lake	120	1 sep., both	Co-oper'tive	H. A. Zable	7‡	Fair	
Fillmore	Fountain	370	Gather cream	do	W. A. Bolles	12§	Good	
	Preston	140	2 separators	Private	Graham & Olson	12§	Ex. good	
	Rushford	440	Gather cream	Stock Co.	L. Knutson	12§	Fair	
	Spring Valley	600	do	Co-oper'tive	Geo. Farmer	12§	Ex. good	Very large make.
	Whalen	225	do	do	O. E. Cangon	12‡	Good	
	Canton	110	do	Corporation	G. L. Hubbell	2‡	Fair	New.
	Harmony	250	do	Co-oper'tive	D. A Mosher	12‡	do	
	Mabel	250	1 sep., both	Private	Bersie & Olson	12§	Good	
Freeborn	Albert Lea	100	2 separators	Co-oper'tive	C. N. Ruble	12‡	Ex. good	

Freeborn	Albert Lea	102	3 separators	Co-oper'tive	O. Sanberg	12‡	Ex. good	Bancroft Cr.
	do	100	2 do	do	P. H. Overgaard	12§	do	Riceland Cr.
	Bath	51	2 do	do	J. St. John	12†	Good	Poplar Grove.
	Alden	81	2 do	do	A. Robinson	10‡	Ex. good	New.
	do	40	2 do	do	J. J. Hane	12†	Good	Carlton.
	Armstrong	75	2 do	do	C H. Ruble	12‡	Ex. good	
	Clark Grove	115	3 do	do	C. H. Dills	12§	do	
	Freeborn	70	2 do	do	D. N. Richards	10†	do	New.
	Geneva	70	2 do	do	M. J. Quinn	12‡	Good	
	Hartland	64	2 do	do	J. C. Sibelrud	12‡	Ex. good	
	Glenville	151	4 do	do	A. W. Trow	12§	do	
	Hayward	80	2 do	do	H. G. Nelson	12†	Good	
	Manchester	80	2 do	do	I. A. Rodsater	12†	Ex. good	
	Mansfield	64	2 do	do	J. H. J. Seedorf	12†	do	
	Moscow	45	1 do	do	C. Rettig	12†	Good	
	Oakland	39	1 do	do	J. T. Purcell	New	do	
	Deer Creek, Ia	80	2 do	do	M. J. Robn	6†	do	State Line.
	Hayward	35	1 do	do	O. A. Boe	4*	New	Summer Valley.
	Twin Lakes	82	2 do	do	J. Widman	12†	Ex. good	Clover Valley.
	do	70	2 do	do	W. Wadsworth	13†	Good	
	Emmons	100	3 do	do	G. H. Emmons	12‡	do	1 Station.
Goodhue	Belvidere Mills	65	1 sep., both	do	G. O. Gaylord	6†	do	
	Cannon Falls	110	2 do	Corporation	Crescent	12†	Fair	1 Station.
	Forrest Mills	180	1 do	Private	W. B. Dickey & Co	12§	Good	
	Goodhue	160	2 do	Co-oper'tive	J. Mc Hugh	7†	Fair	1 Station.
	Kenyon	300	10 do	Corporation	Crescent	12§	Good	7 Stations.
	do	400	Gather cream	Dividend	Lubke Bros	12§	Ex. good	Very large make.
	do	250	7 sep., both	Corporation	P. J. Gutzler	10§	Fair	5 Stations.
	do	300	2 do	Co-oper'tive	O. Bruslaten	12§	Ex. good	1 Stations.
	White Rock	210	1 do	Private	G. O. Miller	12‡	Good	1 Station.
	Wanamingo	100	Gather cream	Stock Co.	O. Garlid	12‡	do	
	do	150	do	Corporation	F. Gutzler	12‡	Fair	Crystal Cr.
	Zumbrota	250	4 sep., both	do	Crescent	12§	do	3 Stations.
	Frontenac	25	1 Separator	Stock Co.	J. S. Goff	12	do	
Grant	Ashby	30	1 do	do	J. M. Stene	3*	Poor	New.
	Elbow Lake	15	1 do	do	H. P. Hanson	1*	do	New.
Hennepin	Minneapolis	70	Gather cream	Private	J. S. Swenson	12†	Good	Golden Cr.
Houston	Freeburg	200	do	Co-oper'tive	G. Brenner	12†	Fair	
	Houston	325	do	Stock Co.	J. P. Onstad	12‡	do	
	Spring Grove	225	do	Private	O. Kjomne	12§	Good	Renewed.
	Wilmington	300	do	do	J. E. Eide & Co	12§	do	
Kandiyohi	Atwater	68	1 separator	Co-oper'tive	D. F. Seneshal	8†	Fair	
	New London	30	1 do	do		8*	do	
	Grove City	70	2 do	do	P. Martenson	12‡	Ex. good	Danielson Cr.
	Lake Elizabeth	50	1 do	do	N. Peterson	8†	Good	
	Lake Lillian	30	1 do	Dividend	Gesoold & Olson	3*	Fair	New.
	Wilmar	100	Gather cream	Private	Bakke & Giere	12*	Poor	
Le Sueur	New Prague	300	do	do	C. Mickus	12†	Fair	
	Le Sueur	450	Gather cream	Private	Patten & Co	12§	Ex. good	Fine outfit.
Lyon	Balatan	40	do	do	Whiting Bros	6*	Fair	

TABLE I.—REPORT OF CREAMERIES OF MINNESOTA, 1893.—*Continued.*

COUNTIES.	Post Office.	No. Patrons.	Process.	Organization.	Proprietors or secretary.	No. mos. oper'd.	Prospects.	Remarks.
Lyon	Tracy	90	Gather cream	Stock Co	A. R. Thompson	6†	Poor	
McLeod	Acoma	30	do	Co-oper'tive	H. Schulte	12	do	
	Biscay	50	1 separator	do	Carl Hagen	12	Ex. good	
	Glencoe	35	1 do	Corporation	E. G. Potter	7*	Fair	
	Hutchinson	90	Gather cream	do	E. G. Potter	12†	Poor	
	Sumpter	30	Set milk	Co-oper'tive	C. E. Barnum	12	Fair	
	Stewart	150	Gather cream	Private	Rehse Bros	2*	Poor	
Martin	Fairmont	25	1 separator	Dividend	W. Stuckmeyer	12†	Fair	New.
	do	200	Gather cream	Private	Sinclair Bros	4‡	Poor	
Meeker	Grove City	50	2 separators	Co-oper'tive	C. C. Reigan	8†	Good	
	Cedar Mills	40	Gather cream	Private	C G. McEwen	12	Fair	
	Litchfield	50	do	Corporation	E. G. Potter	9*	Poor	
	do	..	Separator	Co-oper'tive			Good	Building.
	Manannah		do	do			do	Building.
	Greenleaf		do	do			do	Building.
Mille Lacs	Princeton	209	Gather cream	Stock Co	S. S. Peterson	12‡	Fair	
Morrison	Royalton	60	do	Private	Russel & Montanya	12†	Good	
	Rich Prairie	10	1 separator	Stock Co	P. H. Berg	1*	Poor	New.
Murray	Chandler	25	1 do	Co-oper'tive	O. E. Buss	1*	do	New.
Mower	Adams	330	1 sep., both	Private	Krebsbach Bros	12§	Good	Large make.
	Brownsdale	28	1 separator	Stock Co	Chas. Gage	2*	Fair	New.
	Dexter	100	4 do	Co-oper'tive	E. S. Hoppin	4†	Good	New, 3 stations.
	Waltham	260	Gather cream	do	T. J. Hill	12§	do	
	Grand Meadow	400	do	do	R. E. Crane	12§	Fair	Large make.
	Rose Creek	169	do	Private	Krebsbach Bros	12‡	do	
	Red Oak Grove	66	2 separators	Co-oper'tive	H. Thompson	12†	Good	
	Leroy	250	Gather cream	Dividend	G. W. Harden	12†	do	Large make.
	Lyle	250	do	Private	J. Bonwell	12§	do	
	Taopi	20	do	Dividend	G. W. Harden	9†	Poor	
Nicollet	Courtland	20	1 separator	Stock Co	J. R. Bowen	1*	Fair	New.
	Traverse	250	Gather cream	Co-oper'tive	S. H. Briggs	12‡	do	
Nobles	Worthington	100	do	Private	H. H. Smith	4*	Poor	
Norman	Rindal	200	do	Co-oper'tive	G. Kallandar	6†	Fair	
Olmsted	Chatfield	400	do	do	T. Henry	12§	Ex. good	Large make.
	Forestdale	30	2 sep., both	Private	H. D. Morse	12*	Fair	
	Orinoco	70	2 separators	do	McCray Bros	12†	Good	1 station.
	Laird	200	Gather cream	do	E. S. Hurning	12‡	Fair	
	Pleasant Grove	100	do	Co-oper'tive	R. H. Russell	12†	Good	
	Rochester	173	12 separators	Corporation	G Stoppel	10§	Failed	6 stations.
	do	200	4 sep., both	do	Crescent	12§	Good	4 stations.
	Salem	40	3 separators	do	Crescent	2†	do	
	Viola	200	Gather cream	Private	H. D. Morse	12‡	Fair	

Olmsted	Rock Dell	355	Gather cream	Co-oper'tive	H. Olson	12§	Good	Very large make.
Otter Tail	Dalton	53	do	Stock Co	O. Nelson	3*	Fair	New.
Polk	McIntosh	200	do	Private	K. H. Brokke	2‡	Poor	
Pope	Cyrus	150	do	Co-oper'tive	H. P. Hanson	4†	do	
	Farwell	30	1 separator	do	N. A. Forsberg	7*	Fair	
	Lowry	65	Gather cream	Stock Co	E. O. Holen	10†	Poor	
	Starbuck	60	1 separator	Co-oper'tive	O. J. Johnson	....	Fair	New.
Ramsey	St. Paul	250	5 sep., both	Corporation	Crescent	12§	Good	5 stations.
Redwood	Redwood Falls	18	Gather cream	Private	H. A. Holmes	1*	Poor	Very small make.
	Lamberton	100	do	Stock Co	Hanson & Olson	5*	Fair	
Renville	Bird Island	40	1 separator	Private	J. Richardson & Co	5*	do	
	Hector	40	1 do	Stock Co	W. B. Strom	4*	Good	New.
	Olivia	125	Gather cream	Private	J. B. Foreman	12†	Fair	
Rice	Dundas	150	4 sep., both	Corporation	Crescent	12§	Good	
	Faribault	60	1 separator	Stock Co	F. A. Berry	10†	do	
	Northfield	250	6 do	Corporation	Crescent	12§	Ex. good	Very large make.
	Wolcott	168	4 do	Co-oper'tive	J. H. Peters	12§	do	2 stations.
	Webster	125	3 do	do	O. M. Olson	7§	do	2 new stations.
Scott	Jordan	40	1 do	Private	Zatzel Bros	12*	Good	
Sherburne	Clear Lake	150	1 sep., both	do	Russell & Montanya	12†	Fair	
Sibley	Arlington	210	Gather cream	Corporation	E. G. Potter	12‡	do	
	Henderson	150	do	Private	A. G. Pheoler	12§	Good	
	Gaylord	85	do	do	Miller Bros	7†	do	
	do	160	do	do	Thoele & Son	12‡	do	
	Gibbon	200	do	Co-oper'tive	P. Manderfeld	6‡	Fair	
Steele	Clinton Falls	49	2 separator	do	G. Griffin	12†	Good	
	Havana	25	1 do	Private	Disbrow Bros	12	Fair	
	Blooming Prairie	165	3 do	Co-oper'tive	G. A. Peterson	12§	Ex. good	Large make.
	do	140	3 do	do	J. K. Bennett	12§	do	Union Cr.
	Berlin	74	2 extractors	do	T. N. Brown	12†	Good	
	Pratt	40	1 separator	Dividend	P. Simpson	2*	Fair	Used as station.
	Bixby	23	1 do	Stock Co	P. Simpson	2*	do	Used as station.
	Owatonna	78	Gather cream	Corporation	E. G. Potter	12†	do	
	do	40	1 separator	Private	P. Simpson	4†	Poor	Quit.
	do	58	1 do	Co-oper'tive	W. Glascon	12†	Good	
	do	53	2 do	do	S. G. Kinney	7†	Ex. good	New, Brown Cr.
	do	88	3 do	do	J. Harris	12‡	do	1 stat'n, Gold. Rule
	do	38	1 do	do	N. O. Partridge	12†	Good	Merton Cr.
	Cooleyville	104	3 do	do	F. G. Sloan	12‡	Ex. good	Berlin & Summit.
	Meridan	40	2 do	Dividend	E. T. White	12*	Fair	
	New Richland	37	2 do	Co oper'tive	J. Sullivan	12†	Good	Star Cr.
	Lamond	50	2 do	Dividend	E. T. White	10†	Fair	
Stearns	Avon	19	1 do	Stock Co	T. F. Roach	3*	do	New.
	Melrose	105	Gather cream	Corporation	E. G. Potter	12†	Poor	
	Richmond	160	do	Stock Co	J. Tschumperlin	9†	do	
	Sauk Centre	74	do	Corporation	World's F'r B'ter & Egg Co	5†	Fair	
Swift	Appleton	20	1 separator	Co-oper'tive	P. M. Scott	2*	Poor	New.
Todd	Long Prairie	......	Gather cream	Private	Christianson & Co	....	....	Building.
	Clarissa	50	do	Stock Co	....	2*	Poor	
Traverse	Brown's Valley	100	do	Private	Scheidermantal	6†	do	

TABLE I.—REPORT OF CREAMERIES IN MINNESOTA, 1893.—*Concluded.*

COUNTIES.	Post Office.	No. patrons.	Process.	Organization.	Proprietors or Secretary.	No. mos. oper'd.	Prospects.	Remarks.
Wabasha	Bear Valley	48	1 separator	Stock Co.	A. D. Stowell	4†	Fair	New.
Wabasha	Hammond	150	Gather cream	Dividend	J. Kelley	8†	Poor	
	Mazeppa	80	do	Private	W. B. Dickey	11‡	Fair	
	Plainview	330	1 separator	do	A. Y. Felton	12§	Good	1 station.
Wadena	Wadena	70	Gather cream	do	Hangdahl Bros	5†	Poor	
Waseca	Alma City	50	1 sep., both	do	A. E. Comstock	5*	Fair	
	Morristown	36	1 separator	Co-oper'tive	M. A. Goar	12†	do	Blooming Grove.
	New Richland	50	1 do	Dividend	H. Jeahnings	3†	Good	
	Otisco	50	1 sep., both	do	Bishman & Johnson	4†	Fair	New.
	Janesville	100	Gather cream	Corporation	E. G. Potter	6†	Poor	
	Waseca	100	do	Private	M. D. Armstrong	12†	Fair	
	do	55	do	Corporation	E. G. Potter	7†	Poor	
Watonwan	Madelia	145	5 separators	Co-oper'tive	J. McCarthy	12‡	Good	2 stations.
	do	30	1 do	Dividend	G. Drake	12†	Fair	Fielden Cr.
	St. James	113	2 do	do	F. Gehrls	12‡	Good	
	do	42	1 do	Co-oper'tive	N. J. Nelson	6†	do	New, Sveadahl Cr.
	Antrim		1 do	do			Fair	New.
	Cereal	40	1 do	do	J. Erickson	3*	do	New.
Wright	Fair Haven	150	Gather cream	Private	J. Gould	6†	do	Burned.
	Monticello	150	do	Corporation	Crescent	12‡	Good	
	Rockford	35	do	do	E. G. Potter	12*	Poor	
Winona	Bethany	28	2 separators	Dividend	J. Streblow	7*	Fair	New.
	St. Charles	200	Gather cream	Private	Scott & Keifer	8†	Good	
	Saratoga	350	do	Co-oper'tive	E. B. Gerry	12‡	do	
	Utica	258	do	Private	E. S. Hurning	12‡	do	
	Pickwick	60	do	do	J. T. Whalen	6†	Fair	
Yellow Medicine	Wood Lake	10	1 separator	Stock Co	L. B. Hauck	1*	Poor	New.
	Saint Leo	40	Gather cream	Dividend	F. Anthony	3*	do	Very small make.

* Make for month of June was under 5,000 pounds of butter.
† Make for month of June was over 5,000 pounds and under 12,000 pounds of butter.
‡ Make for month of June was over 12,000 pounds and under 20,000 pounds of butter.
§ Make for month of June was over 20,000 pounds of butter.
Where no such mark is given factories made cheese in summer and butter in winter only.

From the table submitted it will be seen that there were operated this year 201 creameries, 33 of which were built this season; there are also two new ones not yet worked, and seven in the process of construction; in addition and in connection with these were operated 47 skimming stations; there are also 44 factories not operated this year (listed in a table elsewhere), making a total of 301 plants in the state. 230 separators are used in these factories and nearly 26,000 farmers furnish either milk or cream to them. These factories, this year, have turned out nearly 19,000,000 pounds of butter, netting about $4,000,000. 90 creameries and the 47 skimming stations are operated on the separator plan, 90 on the gathered cream plan, 29 use both the separator and the gathered cream plan, one only setting the milk at the factory.

As to the plan of organization they are divided as follows: 86 are co-operative, 62 are private companies, 24 are stock companies, 24 are corporation companies, and 15 run on the dividend plan. Although there are no figures obtainable for comparison, it is safe to state that the amount of butter made in Minnesota creameries this year is greatly in excess of any previous year's production, and that it is also far ahead of any previous year in quality, and while the latter will also apply to cheese, the former statement will not.

We are apparently developing into a butter producing state, cheese, for the time, being nearly lost sight of; I suppose for the reason that the by-product is more valuable from butter making; that it is more of a winter business and prompter returns are obtained for the goods. In this connection I would like to present my *ideal* factory. It would be a combination separator creamery and cheese factory on the co-operative plan. I want fifty patrons and one thousand cows. I want those cows fresh in September and October. I would make butter from September 1st to May 1st, and cheese the other four months. I would make a cheese that would be at its best in four to eight months and market them during the high winter prices. I would expect by such arrangements to net the patrons the very highest returns possible. I think the combination factory the only satisfactory kind for cheese in Minnesota, and it should be built in only such places as will support a creamery through the winter months, and not for a small bunch of one hundred cows to make a small amount of goods part of the year, and rot and rust out between seasons; neither should we continue to make soft quick curing cheese, to be consumed immediately at a low price, then import at high prices during six to eight months following. We ought to at least make sufficient cheese for our own consumption, and in order to do this a part, at least, must be made to keep. We should also increase the varieties to sharpen the appetites of consumers, and thereby increase the demand and consequently the price.

The quality of the butter made in our factories, varies somewhat and could easily be divided into three general classes; *Fancy*, *Fine*, *Choice*. The large bulk of it coming within the intermediate class, while the proportion of the higher class is comparatively small, as is also the proportion of the lower class; and while our average quality is high, there are many factories where chances for improvement exist. I can only give an idea of quality, generally, from the fact that these visits were made at different factories at different seasons of the year, and there might be an injustice done by publishing qualities found at each factory under such circumstances.

Minnesota butter, at the World's Fair, will verify my statements of quality as we scored the highest averages there in two different exhibitions over all other states; and I have no doubt that had the proper exertion been made, we could easily have continued that record throughout the entire exhibit, which would have been very desirable and valuable.

As to the second of these objects, I am pleased to report that I found the creameries (with few exceptions) clean and neat; that a large majority of them were well constructed and equipped for carrying on the business in a neat, orderly way. The patrons delivering clean wholesome milk, and that very few adulterations occurred at such places.

As to the third object:

1. Explaining and advocating the Babcock test as the best method for adjusting dividends and preventing frauds.

2. In giving advice and instruction I had in view the contemplation of the law to produce a clean, wholesome product and acted in the following manner. I examined the butter to ascertain if it had a good wholesome flavor; if it was free from milk and evenly salted (as these are the indications of cleanliness and wholesomeness), and detecting any defects in this respect, I set about to discover the cause and indicate the remedy, never forgetting to impress upon the maker the importance of seeking the best information possible from the proper instructive sources.

In making this tour of inspection I have had an opportunity to note the results from all the different plans and processes used in connection with the manufacture of butter in this state, and, as a result of this opportunity I submit the following propositions:

1. The finest and cleanest butter made is produced by the separator plan.

2. The quickest and best way to advance the dairy interests is through the creamery system, (provided they are rightly organized).

3. The co-operative separator creameries appear to be the most successful and most profitable to the producer.

With these propositions in view, I would reccommend the organization of co-operative separator creameries in all localities where a sufficient number of cows now exist, or can be secured. In localities where this is impossible, the producer should secure for himself a small separator whether he intends to furnish cream to the factory or manufacture his own product on the farm. It is only the expense and the ignorance of the real merit of these machines that retard their universal adoption.

There are already quite a number of these hand separators in use in our state. Waseca county has 43 in operation, Goodhue county 46, several counties 10 to 15 each, and in the state about 200; and excellent results are obtained from them.

While the majority of the separators now on the market are really worth the prices asked for them (from results obtained), such prices are unreasonable, excessive and check their use, and, therefore, retards the advancement of dairying to a great extent; but I hope the time is near at hand when natural competition between manufacturers and dealers will reduce these exorbitant prices to reasonable ones.

There is no reason why the most ordinary dairy farmer in Minnesota may not become very efficient in butter making even at home on the farm. This state has now four organizations laboring in this direction, and they distribute systematically and continuously printed information which, if read by the masses as it should and is calculated to be, and heeded, would add millions of dollars annually to producers' profits and supply our markets with a very different article from that now classed as farmers' or store butter, which is now used almost exclusively for cooking purposes and some even for soap making.

THE DAIRY SCHOOL.—The State Dairyman's Association and the Farmer's Institute are organizations of instruction, and are doing a large amount of good work in this direction; the State Dairy and Food Commission, while not supposed to be an instructive organization, has the same object in view, namely, the advancement of the dairy industry and is willing and glad to give all the information it can, looking toward the upbuilding of this industry.

THE VALUE OF MILK.

The value of milk for butter making depends entirely upon the amount of fat it contains, and on this basis only can its value be determined or dividend equalized. Nearly all creameries in Minnesota have now adopted the Babcock test which is correct and seemingly very simple though it requires some experience and considerable skill to operate it successfully. One of the greatest difficulties encountered is in obtaining a correct sample to operate on.

THE BUTTER MAKER.

The success of all creameries depends, to a great extent and in many cases entirely, upon the butter maker. It therefore behooves the management of creameries to be very careful in selecting a competent person for this position. A few dollars a month extra salary amouts to nothing as compared with securing a first-classs maker.

A butter maker should not only understand handling the tests, separator, cream, butter and machinery, but should be able to give proper instructions to patrons in regard to selection of cows, feeding, care of milk and cans, and should have a good idea of creamery book-keeping, be a good judge of butter and well acquainted with the principal markets. These qualifications can only be obtained by experience and study, and the maker who does not keep himself posted up to date should not be continued in service.

ORGANIZING CO-OPERATIVES CREAMERIES.

I think it not out of place, to outline a plan for organizing co-operative creameries:

Call a preliminary meeting and obtain the presence of all the farmers possible within a radius of six to ten miles, and after having some capable person explain to them the advantages and disadvantages of such an enterprise, have each one sign an agreement pledging himself to join the organization and supply milk from a certain number of cows. When 300 cows are thus pledged, organize these signers into a creamery association under the general laws of 1870, Chapter 9, Sections 1 to 13 (this law is very favorable for such organizations), after which address the several resident creamery supply dealers for plans, specifications and prices, and make contract for a subtantial well equipped plant with the best apparatus and with a capacity in accordance with the future prospects. When started get all the milk possible either from stockholders or non-stockholders and be sure and elect a good business man for secretary and manager, and delegate to him the whole control of the business with the assistance of a good butter maker.

CREAMERIES IN FREEBORN COUNTY.

According to the assessors, reports, Freeborn county contains 18,143 cows, and owing to the intelligent plan of co-operation there adopted, is the best organized dairy county in the state. It now has 22 co-operative separator creameries (and one skim station) operating 46 separators. All of which turn out a very fine quality, as well as a large quantity of butter. Seven of these factories have been built this season. They are very evenly distributed throughout the county, fifteen towns boasting of one each, four having two each, and only one town having none though tributary to five plants, all of which are near its border lines on its several sides. This county, though no better adapted than half the state for this industry, has made a wonderful stride ahead and its example should be followed by other districts in the state, as herein lies untold wealth.

A very correct estimate from this county indicates that during the past year they made two and a quarter million pounds of butter, worth at average prices received for same a half million dollars. Most of this butter was sold in eastern markets, and the money was returned and distributed among the producers. In addition to this they have large quantities of milk with which to successfully raise hogs, and are steadily increasing the fertility of their lands and thereby increasing its value.

In this connection I think it would be interesting to submit the following table:

TABLE No. 2.

COUNTIES.	No. of creameries in operation.	Number of cows in 1893, assessors report.	Butter made in creameries.	Net value of butter made in creameries.
Aitkin	....	702	....	....
Anoka	1	4,365	109,000	$21,800
Becker	2	5,164	224,000	44,800
Beltrami	....	167	....	....
Benton	1	3,151	25,000	5,000
Big Stone	....	2,590	....	....
Blue Earth	3	11,087	272,000	54,400
Brown	3	9,095	436,000	91,560
Carlton	....	544	....	....
Carver	2	8 708	70,000	14,000
Cass	....	500	....	....
Chippewa	....	4,983	....	....
Chisago	1	6,745	90,000	18,900
Clay	3	6,487	213,000	42,600
Cottonwood	....	5,352	....	....
Crow Wing	....	1,560	....	....
Dakota	....	9,504	....	....
Dodge	5	9,467	851,000	170.200
Douglas	3	6,818	122,000	24,400
Faribault	5	10.799	247,000	49,400
Fillmore	8	16,608	1,517.000	303,400
Freeborn	22	18,143	2,329,000	512.380
Goodhue	13	17,344	2,029,000	426,090
Grant	2	4,148	3.300	660
Hennepin	1	13,247	65.000	13,000
Houston	4	10,694	667,000	133,400
Hubbard	....	561	....	....
Isanti	....	4,715	....	....
Itasca	....	51	....	....
Jackson	....	7,329	....	....
Kanabec	....	659	....	....
Kandiyohi	6	9,535	291,000	61,110
Kittson	....	3,473	....	....
Lac qui Parle	....	6,236	....	....
Lake	....	91	....	....
Le Sueur	2	6,763	270,000	54,000
Lincoln	....	3,596	....	....
Lyon	2	5,016	52,000	10,400
McLeod	6	10,127	175,000	35,000
Marshall	....	4,288	....	....
Martin	2	7,273	90.000	18,000
Meeker	2	7.909	82,000	17,220
Mille Lacs	1	1,242	102,000	20,400
Morrison	2	4,905	45,000	9,000
Mower	10	12.104	1,525,000	320,250
Murray	1	4,745	1,000	200
Nicollet	2	7,490	137,000	27,400
Nobles	1	5,341	20,000	4,000
Norman	1	6,844	90,000	18,000
Olmsted	9	12,741	1,595,000	334,950
Otter Tail	1	15,343	10,000	2,000
Pine	....	1,311	....	....
Pipestone	....	2,578	....	....
Polk	1	13,900	25,000	5,000
Pope	4	7,089	95,000	19,000
Ramsey	1	5.202	236,000	29,930
Redwood	2	7,313	21,000	4,200
Renville	3	11,123	63,000	12.600
Rice	5	12,204	730,000	160,600
Rock	....	4,481	....	....
St. Louis	....	1,718	....	....
Scott	1	7,094	30,000	6,000
Sherburne	1	4.885	79,000	15,800
Sibley	5	10,494	490,000	98,000
Stearns	4	14,202	188,000	37,600
Steele	17	11,840	1,512,000	317,520
Stevens	....	2,878	....	....
Swift	1	6,097	....	....
Todd	....	5,590	....	....
Traverse	1	2,013	50,000	10,000
Wabasha	4	7,121	416,000	83,600
Wadena	1	1,590	22,000	4,400
Waseca	7	8,297	242,000	50,820
Washington	....	5,783	....	....
Watonwan	5	7,094	351,000	77,220
Wilkin	....	2,484	....	....
Winona	5	9,201	494,000	98,800
Wright	3	10,833	110,000	22,000
Yellow Medicine	2	6,660	8,000	1,600
Total	201	527.424	18.916.300	$3.924.610

The assessors' reports for 1892 give the number of cows in Minnesota 411,349, and the amount of butter produced, 28,041,476 lbs. This is an average per cow of 68 lbs. On this basis the production from the cows reported in 1893, 527,424, would indicate an estimate yield of 35,864,832 lbs. This might be divided into three grades or classes as follows:

19,000,000 lbs. made in creameries, at 21c per lb.	$3,990,000
7,000,000 lbs. made in dairies, good, at 15c per lb.	1,050,000
10,000,000 lbs. made in dairies, pood, at 10c per lb.	1,000,000
Estimate value of product, 1893	$6,040,000

Now take Freeborn county; 18,143 cows produce 2,329,000 lbs., through the creameries alone; this is an average of 128 lbs. per cow; at this figure the 527,424 cows would produce 67,510,272 lbs., at 21c is $14,177,157. The difference in these summaries show a loss of $8,137,157 from a lack of creamery organization equal to that of Freeborn, and these figures are very low from the fact that to get the actual number of cows in the state quite a percentage would have to be added to the assessors' reports, no doubt at least 15 per cent. In addition to this, considerable butter is now made in Freeborn county outside of the creameries not indicated in this summary.

I wish here to submit another table, showing an estimate (from the best resources at hand) of the extent of our dairy interests at the present time.

TABLE No. 3.

210 creameries, valued	@ $2,500.00	each	$525,000
47 skim stations	1,000.00	"	47,000
44 vacant creamery plants	1,000.00	"	44,000
20 cheese factories	800.00	"	16,000
6,000,000 milch cows	20.00	"	12,000,000
19,000,000 lbs. butter	.21	"	3,990,000
7,000,000 lbs. butter	.15	"	1,050,000
10,000,000 lbs. butter	.10	"	1,000,000
2,000,000 lbs. cheese	.09	"	180,000
Total investments and production in 1893			$18,852,000
Number farmers selling milk and cream to factories			26,000
Number separatros used in Minnesota factories			230
Number separators used on farms about			200

There are also in the state quite a number of creameries that have not been operated for a year or more. Some of these are good plants, well equipped and have been unsuccessful from the lack of interest and thorough mismanagement, and such places offer good openings for experienced men who can build up a good profitable business for themselves and benefit a community. I submit a list of such places for reference to those seeking an opening for a creamery venture.

TABLE No. 4.

COUNTY.	POST OFFICE.	COUNTY.	POST OFFICE.
Becker	Audubon	Martin	Welcome
Becker	Detroit	Martin	East Chain
Big Stone	Ortonville	Marshall	Warren
Big Stone	Graceville	Murray	Fulda
Blue Earth	Lake Crystal	Nobles	Rushmore
Brown	Springfield	Nobles	Adrian
Cotton Wood	Windom	Norman	Hendrum
Cotton Wood	Mountain Lake	Norman	Ada
Dakota	Farmington	Otter Tail	Parker's Prairie
Dakota	Auburn	Polk	St. Hilaire
Douglas	Alexandria	Polk	Crookston
Faribault	Elmore	Pipe Stone	Pipe Stone
Fillmore	Peterson	Sherburne	Elk River
Houston	Hokah	Stearns	St. Cloud
Isanti	Cambridge	Stearns	Belgrade
Jackson	Jackson	Stearns	Brooten
Jackson	Heron Lake	Swift	Benson
Lac qui Parle	Lac qui Parle	Swift	Swift Falls
Le Sueur	Kasota	Wabasha	Lake City
Le Sueur	Waterville	Wright	Montrose
Lincoln	Lake Benton	Yellow Medicine	Canby
Lyon	Marshall		

The advancement of dairying depends greatly upon the solution of two problems: Oleomargarine and poor, dirty butter, the former through legislative regulation, the latter through education and perhaps legislative regulation also.

Oleomargarine is any substance made to take the place of butter and not wholly made from pure milk or cream, and the article now found on the market is made principally from tallow with most of the hard fat (stearine) expelled, to which is added cotton seed oil, aniline coloring matter, and a small amount of milk; it rarely contains 1 per cent. of butter. This compound is made to resemble genuine butter, and is put up in regular butter packages made into prints, rolls, and in every possible way, made to conceal its real character. The cost of manufacturing it is about 7 cents per lb., after which the government gets about 3 cents and middlemen and manufacturers about 10 cents per lb. It is worthy of note that neither the producing nor consuming classes obtain any of the benefits from this impostor. And if, as claimed, it is a clean, wholesome food, there is no reason why it should be allowed to be made and sold in semblance of butter, as the temptation to commit frand is evident, and experience has indicated that nine-tenths of it is sold to the consumer as butter. Our laws require that it be colored a bright pink and the late supreme court decision upholding this law is, in my opinion, the greatest legal victory the dairymen have ever obtained. I call especial attention to the work of this department in its successful fight against this impostor.

Our laws provide against the manufacture or sale of any unclean or unwholesome milk or cream or products made therefrom, and evidently were intended to prohibit the manufacture or sale of unclean or unwholesome butter or cheese, whether it was made from unclean or unwholesome milk or cream, or became so through the process of manufacture, or from a later misuse. It is to be regretted, however, that the present law is not broad enough to cover this. Butter has no greater enemy than very poor butter itself. One pound of such butter will prevent the sale of several pounds of the fine article, and not only this, but it brings butter into disrepute and creates a prejudice against it.

The reasons invariably given for using the substitute, is not the high price of butter, but the difficulty of obtaining a good article. So to-day one of the dairymen's greatest enemies is among themselves. Our creameries have quickly and effectively raised the average quality and through them we have obtained our present high standing as producers of fine butter. Continuing in this direction, we may hope in the near future to produce none but the finest quality which will stimulate the demand for the fine, pure article, to such an extent, that we shall find a remunerative market for all such goods we can possibly produce.

INDEX.

	Page.
Armour Packing Co., affidavit and injunction	16–18
Baking powder	27–29
Creameries, inspection of	9
Cheese factories, inspection of	10–11
Cheese factories, report of E. B. Williams, inspector	71–75
Cheese factories, inspection of	75
Dairy and Food Commissioners, report of	3–30
Eaton, E. N., report of	30–70
Eaton, E. N., samples analyzed	31
Eaton, E. N., fat of individual cows	32
Eaton, E. N., Babcock test	33
Eaton, E. N., preservatives, (Prof. Patrick)	33
Eaton, E. N., milk analysis	35
Eaton, E. N., cream	36
Eaton, E. N., butter	36–40
Eaton, E. N., butter, composition of	37–39
Eaton, E. N., adulterated butter	41
Eaton, E. N., oleomargarine	41–42
Eaton, E. N., oleo oil	41
Eaton, E. N., oleomargarine, healthfulness of	42
Eaton, E. N., oleomargarine, cleanliness of	42–43
Eaton, E. N., patent butter	44
Eaton, E. N., adulterated butter, analysis of	45–46
Eaton, E. N., cheese, report on	47–57
Eaton, E. N., cheese, table No. 2	47
Eaton, E. N., cheese, Minnesota dairymen	48
Eaton, E. N., cheese, fat to solids	49
Eaton, E. N., cheese, work of the commission	49
Eaton, E. N., cheese, Prof. Harry Snyder	49
Eaton, E. N., cheese, Minnesota state full cream	49
Eaton, E. N., cheese, tables of analysis	50–57
Eaton, E. N., lard, report on	57–58
Eaton, E. N., lard, table of analyses	58
Eaton, E. E., vinegar	59
Eaton, E. N., vinegar, analyses of	60–61
Eaton, E. N., baking powder, report on	62–63
Eaton, E. N., baking powder, table of analyses	64
Eaton, E. N., preservatives, report on	65–67
Eaton, E. N., appenda	68–70
Graham, E. J., assistant commissioner, report of	77–88
Graham, E. J., assistant commissioner, table of inspection	78–82
Graham, E. J., assistant commissioner, the ideal factory	83
Graham, E. J., assistant commissioner, quality of butter	83
Graham, E. J., assistant commissioner, world's fair butter	83
Graham, E. J., assistant commissioner, the separator	84
Graham, E. J., assistant commissioner, the dairy school	84
Graham, E. J., assistant commissioner, value of milk	84

Page.
Graham, E. J., assistant commissioner, the butter maker 85
Graham, E. J., assistant commissioner, organizing co-operative creameries........ 85
Graham, E. J., assistant commissioner, creameries in Freeborn county........ 85
Graham, E. J., assistant commissioner, table No. 1........ 82
Graham, E. J., assistant commissioner, table No. 2........ 86
Graham, E. J., assistant commissioner, table No. 3........ 87
Graham, E. J., assistant commissioner, table No. 4........ 87
Graham, E. J., assistant commissioner, oleomargarine........ 88
Honey law........ 76–77
Lard........ 25–27
Milk........ 5
Milk, germs in........ 6
Milk, pasteurizing........ 6
Milk, cleanliness in handling........ 6–7
Milk, samples of, inspected by months........ 8
Milk, average fat, by months........ 8
Milk, standard adopted by states........ 12
Oleomargarine, color, etc........ 19
Oleomargarine........ 14–25
Oleomargarine, seizures of........ 22–25
Oleomargarine, court cases........ 21–22
Prosecution of milk cases........ 13–14
Pink law, regarding........ 20–21
Vinegar........ 29-31
Vinegar, poisoning cases at Excelsior........ 29–30
Weideman, Fred, vs. State of Minnesota........ 19–20

ERROR.

In table No. 3, on page 87, see 6,000,000 cows; change same to read 600,000 cows.

FIFTH BIENNIAL REPORT

OF THE

MINNESOTA
STATE DAIRY AND FOOD
COMMISSIONER.

FROM JULY 31, 1893, TO JULY 31, 1894.

ST. PAUL, MINN.:
PIONEER PRESS COMPANY.
STATE PRINTERS.
1894.

MINNESOTA STATE DAIRY AND FOOD COMMISSION.

BERNDT ANDERSON	Commissioner
E. J. GRAHAM	First Assistant Commissioner
A. H. BERTRAM	Assistant Commissioner and Secretary
E. N. EATON, M. Sc.	Chemist
H. A. HOKEMEIER	Inspector
P. W. WILDT	Inspector
E. B. WILLIAMS	Inspector
J. M. BOHRER	Inspector
C. B. DAVIS	Inspector

REPORT OF THE DAIRY AND FOOD COMMISSION.

STATE OF MINNESOTA,
Office of the State Dairy and Food Commissioner,
St. Paul, December 1, 1893.

To the Honorable Knute Nelson, Governor, and the Legislature of the State of Minnesota:

Sir:—In conformity with the requirements of the law, I now formally report to you the work performed by this department since the last biennial report (July 31, 1892,) to the end of the present biennial period (July 31, 1894.)

In so doing this report will include the work of my predecessor, Hon. A. K. Finseth, up to the time of the confirmation of my appointment by the senate as state dairy and food commissioner, which occurred on the 27th day of January, 1893, and from that time until the present, of the work performed under my direction.

Before the passage of any food laws, this department was granted an appropriation of fifteen thousand dollars or so much thereof as was necessary for the enforcement of the dairy laws. This work consisted of inspecting all milk sold within the state to creameries, cheese factories and private families, and to prevent the importation and sale of any dairy products not conforming to the provisions of existing laws. But the legislature of 1890 extended the work of the department by adding to its duties the inspection of such food products as lard, baking powder, vinegars and spirituous and malt liquors, and for the prosecution of these additional articles, the sum of three thousand dollars was annually appropriated. This sum was inadequate in the extreme, as the whole state of Minnesota was to be covered in the prosecution of the work, and as there had never been any laws regulating the standard of excellence of these products enacted in this state, it is worthy of presumption that the spurious far exceeded the genuine on our markets; but with this sum at our disposal the work of renovation was commenced, and, a most vigorous warfare it was, and after two years of vigilance the markets of the state were purified to the extent that consumers now need not be swindled in purchasing any of the food specified in our laws. Colored vinegars are banished from the state, and therefore do not come in competition with cider vinegar it so much resembles. Baking powders containing alum are so branded and sold on their merits. We have to watch the lard market very close, as there are yet some frauds practiced by adulterating it with tallow, but it is not practiced to the extent it was when the law took effect. The vigilance of the department will continue in all these lines until a desired result is brought about. When the food laws were enacted and placed in the hands of this department for enforcement we found a worse condition in those lines than we had dared expect, and was compelled to enlist the entire force of the department in this work of extermination, and to accomplish the result, we could not give the dairy interests of the state the attention it was entitled to receive, but we viewed the matter philosophically and decided that after the food market had once been renovated, both the dairy and food interests could be looked after; in justice to both, this view has been verified. Since the issue of our last biennial report for the period ending July 31, 1892, we have made the dairy interests our special care. The creameries and cheese factories have never in the history of the department had such careful inspection as during the past year, the results of which have been very satisfactory. For two years previous to this we have at the solicitation of the managers of cheese factories and also of the state dairymen's association placed a cheese instructor in the field in order to bring about more uniform results; the wisdom of this course has been fully justified by the results that have accrued. But since the farm school has been established, in order not to assume any of their duties, we have withdrawn our instructor and refer all parties to the farm school, of which we are justly proud, for instruction in all dairy matters. We were well aware, that when the department placed an instructor in the field, that we were exceeding our authority in the matter, as the dairy and food department was entirely a police and not an educational department. We are therefore glad to relieve ourselves of this branch of work and place it in the hands of a purely educational institution, viz.: "The Minnesota Farm School," thereby allowing the dairy and food department to confine itself entirely to duties for which it was created.

Following the financial statements, I will take up the various dairy and food products, the enforcement of which comes within our jurisdiction, and report on each article in their order and accompany the same with statements in tabulated form, with reference to the amount of work done in each particular line and their condition as to purity. I do not intend at this time to make a highly colored report, but to place the work of the department before the public in a clear and terse form that all interested may know of the scope and magnitude of the work required of this department, and how well the duty is performed and the interests of all concerned are cared for, all of which is most respectfully submitted for your consideration and approval. Most respectfully,

BERNDT ANDERSON,
Commissioner.

RECAPITULATION OF DISBURSEMENTS FOR THE YEAR ENDING JULY 31, 1893.

Salaries	$12,753.49
Traveling expenses	1,560.32
Purchases	501.86
Postage	265.80
Express and livery	249.91
Telegrams	9.55
Laboratory supplies	43.89
Rent, Minneapolis office	275.00
Gas for laboratory	59.43
Court expenses	108.18
Total	$15,827.43

DISBURSEMENTS FOR YEAR ENDING JULY 31, 1894.

Salaries	$11,541.65
Traveling expenses	1,405.47
Purchases..	140.42
Postage	209.61
Express and livery	337.95
Telegrams	15.34
Laboratory supplies	140.55
Rent, Minneapolis office	175.00
Gas for laboratory	41.23
Veterinary services	10.00
Total	$14,017.22

MILK.

The dairy and food department comes more directly in contact, in the prosecution of its work, with this one article of food and diet, than with any other with which it is called upon to deal. It is a commodity that enters into every household, the rich and the poor are alike consumers, and it therefore becomes doubly important that it should receive our untiring watchfulness, to prevent adulteration in any particular. It is the food entirely depended upon by a large portion of the infants of the country and their health and growth largely depend upon a pure and healthful article free from all impurities. It is a luxury enjoyed by old and young alike and especially sought after during the warm months. A cool glass of milk on a hot day in its natural freshness and purity is a nectar fit for the gods. The laws of Minnesota regulating the sale of milk are very good as far as they go, but do not extend far enough. They were enacted more with a view of establishing a standard of richness, below which milk could not be sold, than for any other purpose, thereby preventing the placing upon the market, by unprincipled vendors, skimmed or watered milk. Now that this has been successfully accomplished, I would recommend that the laws of the state be so amended, that all milk sold upon our markets should be pasteurized in order to destroy any bacteria or disease germs that might be contained therein. Milk is probably more susceptible of contamination than any other article of food we use, and too much care cannot be taken with reference to its environments. Pasteurization (from Dr. Pasteur, a French scientist,) of milk is a process not so well known as sterilizing, and unfortunately (see N. J. Dairy Comm'r Report 1891, pp. 133) one which is not so simple in its accomplishment. It consists ordinarily in heating milk to a temperature of 70°c, to 80°c (158° to 176° F.), and then rapidly cooling. Various forms of apparatus have been devised for the purpose, though none of them are adapted for accomplishing the operation easily on a small scale. In some of the forms of apparatus the milk is brought in contact with thin metal sheets, which are warmed to the required temperature by steam. The best form of apparatus is one described by Bitter (Zeit fur Hyg., 1890). It consists essentially of a large metal vessel containing a coil of pipes, which can be supplied with steam. In the vessel are also some paddles, which can be readily revolved by turning a crank. After the milk is placed in the vessel, the steam is turned on and paddles set in motion. The motion of the paddles keeps the milk circulating and insures a uniform heating. The temperature rises rapidly, and the steam is kept in the coil until the desired temperature is reached and then turned off again. If it is only desired to heat the milk for a moment, the milk is now taken out of the vessel and rapidly cooled with ice. If, however, it is desired to continue the heating for a short time, the milk is allowed to remain in the vessel, and a small amount of steam allowed to pass through the coil as long as desired. By a little care the temperature can be kept constant for a long time, with almost no variation. In all cases the milk is taken from the apparatus after heating is finished, and cooled as rapidly as possible.

Milk heated in this way will become completely sterilized, and all pernicious bacteria found in the milk be completely destroyed. It is claimed that typhoid germs are killed at 58° to 59°, pneumonia germs at 55° to 69°, vaccine at 60°, and tuberculosis germ at 69°. The heating must be kept up for half hour to destroy the tuberculosis germ, but the others succumb in a much shorter period. Whether this process or the simpler process of sterilizing is employed is yet to be decided upon, but a process with a view of destroying disease germs must sooner or later be adopted.

Cleanliness in the handling of milk is of the utmost importance, and has much to do with its keeping qualities. Before beginning to milk, the udder should be thoroughly brushed (washing is still better) so that all dirt and particles may be thoroughly removed. The hands should be kept dry during the process, never dipping them in the milk and wetting the teats, as the drippings fall back into the milk, contaminating it. As soon as the pail is full it should be removed, strained and cooled as quickly as possible, never allowing it to set in the barn a moment longer than necessary, as it will absorb the odors surrounding it in an inconceivable short space of time, and that odor will follow it into the butter or whatever it may be converted into, and no known process will exterminate it. Cleanliness in and about the barns and stables is of the utmost importance, as the health of the cows are dependent upon it, and good, wholesome, healthy milk can be obtained only from healthy cows. Feeding is another important essential in the production of good dairy products. Brewers' malt, vinegar waste or any fermented food should under no conditions be given the cow, as it creates fever in the animal, and the milk is readily affected thereby.

It is to be regretted that the nations of the world that make any pretense at dairying do not pattern more closely after the thorough system employed in Denmark and Sweden. The cow is treated as a dear friend, her every want and whim supplied. The barns are models of cleanliness that present the attractions of a home. Danish and Swedish girls neatly and prettily dressed do the milking, this fact alone assures kind treatment, rather than the use of a heavy boot or the vigorous application of a milking stool at the hands of a heartless wretch, demanding obedience from a slow moving cow.

The laws in those countries are rigidly enforced, and are very exacting. The milk is not only inspected with reference to its richness, but also its sanitary condition as well. The result of this system, maintained through a long series of years, has placed the dairy products of our Danish and Swedish friends far beyond the reach of competition of any other nation on earth. There is no valid reason why the United States, and more especially Minnesota with all her rich natural advantages, of pure air, water, grass, and indomitable pluck and courage of its farmers and dairymen, together with the improved appliances at hand, should not inaugurate a system of dairying, and strictly adhering to it, compel the pretty dairy maids of Denmark and Sweden to at least divide the laurels during the years to come.

Herewith I will call attention to the following table, which represents the number of samples of milk inspected at Minneapolis, St. Paul, Duluth, Winona, Stillwater, St. Cloud and other towns, also including milk sent into the cities on the various lines of railroad. This table does not, however, include milk inspected at cheese factories and creameries, which will follow later on.

Numbers of sample of milk inspected from August 1, 1892, to July 31, 1894, by month:

Month.	Year.	Samples Inspected.	Average Fat.
August	1892	69	3.72
September	1892	68	3.86
October	1892	118	3.67
November	1892	43	3.97
December	1892	98	3.66
January	1893	117	3.75
February	1893	190	3.67
March	1893	431	3.60
April	1893	132	3.61
May	1893	166	3.54
June	1893	297	3.51
July	1893	172	3.67
August	1893	216	3.47
September	1893	186	3.69
October	1893	192	3.82
November	1893	129	3.80
December	1893	100	3.55
January	1894	135	3.68
February	1894	213	3.75
March	1894	325	3.53
April	1894	120	3.64
May	1894	175	3.51
June	1894	270	3.48
July	1894	160	3.55
Total	....	4,142	3.63⅓

Referring to the reports of the dairy commissioners of the states of Massachusetts, Michigan, New York, New Jersey, Vermont and Wisconsin, my attention is called to the milk standard adopted by those states, and will give it for the information of those interested.

Minnesota—Water, 87; solids, 13; butter fat, 3.5
Massachusetts—Water, 87; total solids, 13; solid, not fat, 9.3.
Michigan—Water, 87.50; total solids, 12.50; fats, 3.
New York—Water, 88; total solids, 12; fat, 3.
New Jersey—Water, 88; solids, 12.
Vermont—Total solids, 12.5; solids, not fat, 9.25.
Wisconsin—Butter fats, 3.

The specific gravity of normal milk at 60° F. ranges from 1,029 to 1,034. Skimmed milk at the same temperature has a specific gravity of from 1,034 to 1,037. The specific gravity of watered milk is from 1,028 downwards in accordance with the amount of water the milkman's conscience will allow him to use, and that amount varies with the milkman.

You will perceive at a glance that the standard for butter fats is higher in Minnesota than in any of the others. I fail to see the reason that it should not be placed at 3.5 per cent. in all the states. It cannot be that the wild pasturage of this state is more nutritious than the tame pastures of the older states. The milk gathered by our inspectors show tests every day where it ranges from 4.00 to 5.50 per cent and very seldom below 3.50, unless it has been tampered with. It was thought when the Minnesota standard was adopted, that 3.5 was excessive, but after eight years' experience, we are satisfied that it is none too high. This high standard has been the cause of bringing a better grade of cows into our state, and purging it of the useless and expensive scrub. The cheese factories and creameries of the state have adopted the best plan in buying their milk; a person now gets what his milk is worth in fats, and it is the only honest way of dealing in this commodity and insuring even-handed justice to all the patrons.

The following list of cases were tried before the municipal and district courts of Hennepin and Ramsey counties, for adulteration of milk, both by skimming and adding water, and also for failing to procure a license before engaging in the sale of milk, all of which is in violation of the laws of the state:

State of Minnesota vs. O. F. Chamberlain, in municipal court at Minneapolis, Minn. Warrant issued March 27, 1893; case tried before Judge Mahoney; defendant plead guilty of selling milk adulterated with water, as charged; fined $25 and costs. Witnesses: H. A. Hokemeier, J. M. Bohrer and E. N. Eaton.

State of Minnesota vs. H. C. Johnson, in municipal court at Minneapolis, Minn. Warrant issued April 3, 1893; case tried before Judge Elliott; defendant plead guilty of having sold milk which had been skimmed, as charged in the complaint, and was fined $25 and costs. Witnesses: H. A. Hokemeier, E. N. Eaton and C. B. Davis.

State of Minnesota vs. R. Hanson, in municipal court at Minneapolis, Minn. Warrant issued April 3, 1893; case tried before Judge Elliott; defendant plead guilty of having sold adulterated milk as charged and was fined $25 and costs. Witnesses: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. D. D. Sullivan, in municipal court at Minneapolis, Minn. Warrant issued June 21, 1893; case tried before Judge Elliott; defendant charged with selling milk without a license, found guilty and fined $10 and costs. Witness: H. A. Hokemeier.

State of Minnesota vs. Chris. Nelson, in municipal court at Minneapolis, Minn. Warrant issued June 22, 1893; case tried before Judge Elliott; defendant charged with selling milk without a license, found guilty and fined $10 and costs, $5 remitted. Witness: H. A. Hokemeier.

State of Minnesota vs. P. E. Neilson, in municipal court at Minneapolis, Minn. Warrant issued June 22, 1893; case tried before Judge Elliott; defendant charged with selling milk without a license, as charged; fined $25 and costs, $15 remitted. Witnesses: C. B. Davis and E. N. Eaton.

State of Minnesota vs. John Miller, in municipal court at Minneapolis, Minn. Warrant issued June 22, 1893; case tried before Judge Elliott; defendant found guilty of selling illegal milk and was fined $25 and costs; $15 remitted. Witnesses: C. B. Davis and E. N. Eaton.

State of Minnesota vs. Jens Hanson, in municipal court at Minneapolis. Warrant issued July 11, 1893; case tried before Judge Mahoney; defendant charged with having refused to procure license for the sale of milk; was found guilty as charged, and on his taking out a license the case was dismissed. Witness: H. A. Hokemeier.

State of Minnesota vs. H. Simonson, in municipal court at Minneapolis. Warrant issued July 25, 1893; case set for July 28th; defendant charged with having sold adulterated milk; defendant appeared and waived examination, was bound over to the grand jury; case still pending. Witnesses: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. J. H. Kroohn, in municipal court, Minneapolis. Warrant issued July 25, 1893; case set for July 29th; defendant charged with having sold adulterated milk; appeared at the time set, waived examination and was bound over to the grand jury; case still pending. Witnesses: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. M. N. Graham, in municipal court at Minneapolis. Warrant issued August 30, 1893; case called August 31st; charged with refusing to procure a license for the sale of milk; defendant appeared and procured a license; fined $10 and costs, fine remitted.

State of Minnesota vs. George Staples, in district court, Ramsey county, Minn. Warrant sworn out September 26, 1893; charged with selling watered milk; indictment found by grand jury; case came before the October term of court; defendant appeared, plead guilty and was fined $20 and costs. Witnesses: E. J. Graham, E. N. Eaton and J. M. Bohrer.

State of Minnesota vs. James McGrath, in district court of Ramsey county, Minn. Warrant sworn out by J. M. Bohrer, Sept. 26, 1893; indictment found by grand jury; case came before the October term of the district court; defendant appeared and plead guilty of having sold watered milk; was fined $20 and costs. Witnesses: E. J. Graham, E. N. Eaton and J. M. Bohrer.

State of Minnesota vs. Herman Freutel, in district court of Ramsey county, Minn. Warrant sworn out by J. M. Bohrer Sept. 26, 1893; indictment found by grand jury; case came before the October term of the district court; defendant appeared and plead guilty of having sold watered milk; fined $20 and costs. Witnesses: E. J. Graham,E. N. Eaton and J. M. Bohrer.

State of Minnesota vs. Hans Hanson, in municipal court, Minneapolis, Minn. Warrant issued Jan. 10, 1894; charged with selling milk without a license; before Judge Mahoney; found guilty; fined $10 and costs. Witnesses: H. A. Hokemeier and C. B. Davis.

State of Minnesota vs. John Neimann, in municipal court in Minneapolis, before Judge Mahoney; warrant issued Jan. 13, 1894; charged with selling milk from a wagon that did not bear name and number of the licensee; found guilty, and find $10.

State of Minnesota vs. H. Hueffner, in municipal court, before Judge Corey; warrant issued March 9, 1894; charged with selling adulterated milk; plead guilty; fined $25. Witnesses: E. B. Williams and E. N. Eaton.

State of Minnesota vs. Bernard Errick, in municipal court, St. Paul, Minn., before Judge Corey; charged with selling milk from a diseased cow; warrant issued March 10, 1894; plead guilty; fined $10, and ordered to dispose of the cow. Witnesses: E. B. Williams, Dr. H. M. Reynolds and E. N. Eaton.

State of Minnesota vs. F. R. Peck, in municipal court, St. Paul, Minn., before Judge Twohy; charged with selling adulterated milk; warrant issued March 26, 1894; plead guilty and find $10. Witnesses: E. B. Williams and E. N. Eaton.

State of Minnesota vs. Henry Freutel, in municipal, in St. Paul, Minn., before Judge Twohy; warrant issued March 26, 1894; charged with selling watered milk; plead guilty; fined $10. Witnesses: E. B. Williams and E. N. Eaton.

State of Minnesota vs. Henry Freutel, in district court, before Judge Kerr; warrant issued June 11, 1894; charged with selling watered milk; second offense; defendant found guilty and fined $25. Witnesses: E. B. Williams and E. N. Eaton.

State of Minnesota vs. W. H. Potthoff, in municipal court, St. Paul, before Judge Orr; warrant issued May 25, 1894; charged with selling skimmed milk; state failed to prove its case and defendant dismissed. Witnesses: E. B. Williams and E. N. Eaton.

State of Minnesota vs. C. H. Parker, in justice, at Farmington, Minn., before Jas. Frail, J. P.; warrant issued July 3, 1894; charged with selling adulterated milk; plead guilty, and fined $10 and costs. Witness: C. B. Davis.

State of Minnesota vs. Albert Matter, in municipal court, city of Duluth, Minn., before Judge Winge; warrant sworn out June 27, 1894; charged with selling milk without a license; plead guilty, and fined $10. H. A. Hokemeier, complainant.

OLEOMARGARINE.

At no time in the history of this state have the manufacturers of oleo made such determined efforts to establish a headquarters for their product in the large cities of the state as at the present time. Their determination in this direction is certainly worthy of a far better cause, and at no time have they met with such stubborn resistance, and with so many setbacks, at the hands of the dairy and food department. For some time past the manufacturers have been satisfied with having Duluth as their headquarters or distributing point, and as long as they confined their sales to the original packages in the hands of the importer's agents, the department under existing national laws, did not feel warranted in interfering with their business. This course seemed to embolden them, possibly imbuing them with the idea that the laws were all favorable to them, and that we were afraid to act in the matter. But as time went on, they sought for other fields to conquer, and had the audacity and downright effrontery of their class to seek to capture both Minneapolis and St. Paul, directly under the nose of this department, as a base of operations, these cities being central, offered inducements that Duluth did not possess.

When the inter-state commerce law went into effect, oleomargarine was packed in tubs of from forty to sixty pounds each, and according to the rulings of the inter-state commerce commission, it could not be seized while in the hands of the agents of the manufacturers while the original package was unbroken, but that as soon as it was broken or was sold or transferred to third party, it immediately entered into the commerce of the state and became liable to seizure and to the laws of the state. It soon became apparent to the manufacturers that the large size of their packages seriously affected their sale, knowing full well that the stuff could not be retailed, and that dealers only could handle such large packages. So, in order to evade the law, they have since shipped it in packages containing from ten to sixty pounds and delivering it directly to the consumers in such quantities as is desired. It has therefore been shipped in packages that were sewed up in burlaps, but this method has been abandoned and the smaller packages adopted; the tubs used are as near in imitation of the ordinary butter tubs as they can be made and many of them are branded as "Kansas Dairy" and "Kansas Creamery," etc., and in every instance are placed upon the market in as close imitation of the product of the creamery as it is possible to get it. Were it not for the "original package" clause of the inter-state commerce law, it would be much easier to get evidence that would materially assist in obtaining convictions in our courts. However, all the cases we have now on our hands, are those wherein the parties have violated the state or the inter-state laws. They evidently felt that as their position as agents was impregnable, they would go a step farther, but in so doing they made their mistake, and the courts will decide the matter.

These methods of placing it on the market have seriously hampered the department in its work, and while our laws give us jurisdiction over stores, hotels, boarding houses, etc., we have no right to enter the sacred precincts of a private home and make seizures. When our inspectors commenced their raids the past fall, they found a very unsatisfactory state of affairs. It seemed as if many of the boarding houses, restaurants and some of the hotels had all at once decided to substitute "bull butter" for the genuine article. The work of seizure commenced at once both in St. Paul and Minneapolis. The result was that the department was the richer by several tons of "soap grease" than at the start. The raid was also taken up at Duluth and a rich haul was made there. Some of the parties plead guilty and paid their fines, others, to avoid notoriety, relinquished all claims to what was captured and about a dozen have concluded to let their cases go to the courts for settlement, which cases are now pending. In all cases the attorneys for the packing houses appear in defense of the law breakers.

The parties whose cases are now pending are not all charged with the same offense. The charges are the violation of the pink law, requiring all oleo to be colored a bright pink, the selling it at retail, and the finding of broken packages in the hands of retailers and also selling it for pure butter.

The department has followed up these seizures with such persistency that the oleo business has greatly suffered by it, and the agents began to devise means to try and prevent us from performing our duty in the matter, and as a last resort one W. M. Montgomery, an agent of Armour Packing Co. at St. Paul, made the following affidavit in order to procure an injunction restraining us from seizing any more of their goods. This affidavit will give the people generally an idea of the virtuous character of these oleo people, and how much they have suffered at the hands of the farmers; they actually pose as benefactors. Here is the affidavit:

UNITED STATES CIRCUIT COURT, EIGHTH CIRCUIT. DISTRICT COURT OF MINNESOTA, THIRD DIVISION.

Armour Packing Co., Complainant, against Berndt Anderson, Defendant.

STATE OF MINNESOTA,
County of Ramsey.

W. M. Montgomery, being first duly sworn, deposes and says, that he is the agent of the complainant, Armour Packing Co., and has been and is in charge of the agency and place of business of the complainant, at St. Paul, Minnesota, and of the sales of oleomargarine made by the complainant, at said agency, for four years last past. That for more than six years last past this affiant has been engaged in and acquainted with the manufacture and sale of the commercial article known as oleomargarine. * * * That the principal ingredients are neutral lard, oleo oil and butter. That coloring matter is also used in its manufacture, which coloring matter is a harmless substance manufactured from a seed known as annatto, and is the same substance which is universally used by the manufacturers of butter in coloring the butter made by them, and is the same substance which produces the yellow color in yellow butter at most seasons of the year. That in order to make the compound merchantable, and to insure its remaining sweet and salable, it is absolutely necessary that the ingredients used in its manufacture should be the best of their different kinds, and pure and sweet, and that the process of manufacture should be conducted in a cleanly manner.

That the ingredients used are pure, sweet, wholesome and nutritious, and that the process of its manufacture is conducted in a cleanly and wholesome manner, and that the product itself is wholesome, nutritious and in every respect fit for human food.

For six years last past this affiant has been acquainted with the substance which has been manufactured and dealt in in the United States, and shipped to and sold in all the different parts of the country under the name of oleomargarine, and that the article known by that name, wherever manufactured, shipped or dealt in, has been and is substantially the same thing; that it is of a yellow color, closely resembling yellow butter in its color, texture and taste, and he has never known of any article being manufactured or sold under the name of oleomargarine which did not closely resemble butter in all the respects above stated, and it is impossible to manufacture oleomargarine in such a way that it shall not look like butter to a greater or less degree, depending upon the proportions of butter and oleo oil used in its composition, and that oleo oil closely resembles in color butter in which no coloring matter has been used, and varies in color with the different seasons of the year precisely as the color of butter varies, being a light yellow in winter and a dark yellow in summer, * * * and the same is the oleomargarine of commerce, and is of the color of the oleomargarine of commerce, and is pure, sweet, wholesome and nutritious, and in every way fit for human food, and is in no way deleterious to the public health.

That in the state of Minnesota the sales of oleomargarine have been large for several years, but the demand for the same as an article of food has greatly increased during the past few months for the reason that a large portion of the population of the state has learned that it is superior to most of the butter in the market, and that they can procure the same at a less price than is ordinarily asked for butter, and they have gladly bought and used the same as a substitute for butter.

That oleomargarine is a patented article of commerce, and it has always commercially been made with an artificially yellow color as patented.

That annatto and cotton seed oil are, and have been used by the manufacturers of oleomargarine to color the same, and it is this coloring preparation that gives it its fine yellow color.

The same substance is now used by the manufacturers of butter, to color their butter, but the manufacturers of oleomargarine used this color preparation for coloring their oleomargarine long before the manufacturers of butter used the same for coloring butter.

That this affiant has been for several years last past acquainted with the manufacture of butter, and the process of its manufacture, and the preparation used to color the same, and today nearly all the butter sold in the markets of the state of Minnesota, is artifically colored with annatto and cotton seed oil, and for several years last past, the butter sold in the markets and stores of Minnesota has been colored in imitation of oleomargarine made by the complainant and by all the leading manufacturers thereof. * * * The complainant has never sold, or offered for sale, and it does not propose hereafter to sell or offer for sale, oleomargarine for butter, or as butter, and that it has always sold and offered to sell, its said oleomargarine at its said agencies in Minnesota, as and for an article of commerce, and as and for an article of food, and the same has always been bought by the purchaser thereof as and for oleomargarine, and not as and for butter. * * *

And this affiant further says, that on the 20th day of November, A. D. 1893, he went to the office of the defendant, to see him and ascertain what he proposed to do about the oleomargarine and business of the complainant at its agencies in the state of Minnesota, and he informed him that the complainant had on hand at its agencies a large amount of oleomargarine in the original unbroken packages, in which it had been packed and shipped by it from Kansas City to St. Paul and Duluth for sale in such packages for human food, and this affiant desired to know whether the defendant proposed to seize and confiscate the same, and to break up and destroy the business of the complainant at its said agencies in Minnesota, and the defendant told this affiant that he did, and that he would seize and take possession of said oleomargarine, and of all the oleomargarine he could find in the state of Minnesota, whether it was in the original unbroken packages or not, and whether it was in the possession of the complainant or its agents or not, and he would continue to seize and take possession of any oleomargarine the complainant shipped into the state of Minnesota for sale, or offered for sale in the original packages, and would continue to do so until he had broken up and destroyed the sale of oleomargarine in any form or packages, or under any circumstances whatever by the complainant or any other party or person, provided said oleomagarine was not colored a bright pink.

And this affiant further says, that to color oleomargarine any other color than yellow would utterly destroy its commercial character and destroy its value and its sale.

That the yellow color of the oleomargarine of commerce is as much a part of said commercial article known as oleomargarine, as is any other characteristic or ingredient thereof, and much more so.

The above are such portions of the affidavit of W. M. Montgomery (Armour's agent) as is of interest to the department and dairy men throughout the state, and is a series of misstatements throughout, made for the purpose of enjoining us from interfering with their sales. The application for an injunction was made to Judge Nelson, of the United States circuit court, entirely without our knowledge and a temporary injunction granted, to-wit:

UNITED STATES CIRCUIT COURT, EIGHTH CIRCUIT. DISTRICT OF MINNESOTA, THIRD DIVISION.

Armour Packing Co., Complainant, against Berndt Anderson, Defendant.

An application for a writ of preliminary injunction having been made by the complainant in the action above entitled, and the hearing of the motion therefor fixed for the 9th day of January, A. D. 1894, and it having been made to appear that there is danger of irreparable injury being caused to the complainant before the hearing of said application for said writ of injunction, unless the defendant is, pending such hearing, restrained as hereinafter set forth, and the complainant having filed herein a bond in the penal sum of one thousand dollars for making good to the defendant the damages and costs that may be awarded it by reason of such injunction.

Now, on motion of Edward P. Sanborn, Esq., the complainant's counsel,

It is ordered, that the defendant, Berndt Anderson, his servants, agents, deputies and employes, be and he, and each of them, are hereby specially restrained from seizing or taking possession of any of the stock of oleomargarine in the bill of complaint referred to, belonging to the complainant in the state of Minnesota, and from seizing or taking possession of any of the oleomargarine of the complainant, which it may hereafter ship into the state of Minnesota in the original unbroken packages in which it is shipped by the complainant, while in its possession, or in the possession of the agents of the complainant in the state of Minnesota, from the place of its manufacture by the complainant outside of said state, and from in any way interfering with the business of the complainant, in the bill of complaint referred to, in the state of Minnesota, or with the sale or the delivery by the complainant of its oleomargarine to the purchasers thereof in said state in the original unbroken commercial packages, in which the same is shipped into the state of Minnesota by the complainant, until the hearing upon said application for a writ of injunction, and the further order of the court in the premises.

(Signed) R. R. NELSON,
Judge.

Dated Nov. 22, A. D. 1893.

It is certainly news to the dairymen and others of this state, to learn from this affiant that butter is made in imitation of oleomargarine, as it has always been supposed that the opposite was the case, but when this statement comes from so high an authority as an agent of a packing house, we have no other resource than to accept it as a fact.

In his statement regarding the composition of oleo, he says it is composed of neutral lard (probably meant entrail lard) oleo oil and butter. He did not occupy any time telling the court that a great portion of the oleo oil was obtained from city rendering establishments, where horses and other animals are reduced to oil. He would rather not have his patrons know anything about these things.

Regarding the color, which he states to be annatto, we have this to say, that we have analyzed a great many samples of Armour's and other brands of oleomargarine, and we have yet to discover the first sample colored with annatto. The coloring matter that they have used has been found to be methyl orange, which is made from aniline so commonly used as a dye. He also states that for the past few months the sales of oleomargarine has greatly increased, owing to its superiority over butter. This must certainly be cheering news to the dairymen of the state, who pride themselves on the high standard of their product. If such is the case, I ask, why do the manufacturers of oleo brand their stuff "Kansas Dairy," "Kansas Creamery," if such is the case; this action on their part gives the lie to the whole matter. They even procure the same tubs used by dairymen, in which to pack and ship their oleo. Their intention and aim is to make it appear as near like butter as possible, and their whole business is one of fraud and deception.

The law passed in this state in 1890, compelling oleo to be colored a bright pink, is seriously objected to by these people. This law is the same as the New Hampshire law, and has been held constitutional, and a case of the same kind has gone to our supreme court recently, which was also held to be constitutional.

In the matter of Fred Weideman vs. State of Minnesota, the state supreme court rendered the following decision:

STATE OF MINNESOTA, SUPREME COURT, OCTOBER TERM, A. D. 1893, NO. 166.

In the matter of Fred Weideman on Habeas Corpus, Fred Weideman, Respondent vs. State of Minnesota, Appellant.

1. The provisions of Gen. Laws, 1891, Ch. 11, "An act relating to the sale of imitation butter" are valid as a legitimate exercise of the police powers of the state.

2. The offense prohibited in Sec. 1 of said Ch. 11, is a misdemeanor and the penalty therein specified is to be recovered in accordance with the provisions of G. S. 1878, Ch. 78, Sec. 10, by a criminal prosecution in a court of competent jurisdiction.

The above Ch. 11, Gen. Laws of 1891, is the pink law referred to and its constitutionality being upheld by the supreme court of the state has placed a very effective weapon in the hands of the Dairy and Food Department, and has created consternation in the ranks of the manufacturers of slaughter house butter.

This department denies emphatically that any of its members ever told Mr. Montgomery that it would seize all oleo that came into the state regardless as to whether it was in the original packages or whether in the hands of the agents or not. The department has had able counsel, and is fully aware of its jurisdiction in the matter, and has studiously avoided interfering with oleo in the hands of the agents, but as soon as it left the hands of the agents and entered into the commerce of the state, we held that we have the power to seize and confiscate the same whether in the original package or not, which course we have pursued and will continue to pursue until compelled by law to desist. The oleo people claim that if compelled to color their product pink, that it will virtually kill their trade. They certainly could not expect us to aid in passing laws beneficial to them, and we sincerely trust that their views in the matter are the correct ones. But we have this to say, that if oleomargarine possesses all the virtues they claim for it and is so superior to butter, why cannot the public educate themselves to like a pink color as well as yellow, as persons must educate themselves in order to relish oleo. "A rose by any other name would smell as sweet," the same rule holds good with oleomargarine. I desire at this time to express my high appreciation of the untiring efforts of the inspectors of my department, every member of which is in hearty accord and sympathy of the laws of the state, and if the unholy traffic is not suppressed it will not be on account of their lack of vigilance.

The state of Minnesota will ere long cease to be one of the wheat raising states of the union, owing to the unsatisfactory returns from the wheat fields. It will naturally gravitate to that of diversified farming, which is the true solution of our agricultural problem; in that case dairying and stock raising will be the leading features. No state in the union is more blessed with all the natural advantages for this line of industry as to pure air, clear and sparkling water, and rich, nutritious wild grasses, than is the North Star state. It therefore becomes incumbent on every citizen of the state, who has its welfare and material interests at heart, to unite and overthrow this giant octopus that is trying to fasten its deathly tentacles upon us and prevent us from becoming what God destined us to be "the leading dairy state of the Union."

You will notice by perusing the large number of seizures made as hereinafter specified, that the same has been placed in cold storage. This is a course we have invariably pursued where the seizures have been made in hotels, restaurants and boarding houses, etc., and after waiting a sufficient time for the parties to replevin the same and they fail or refuse to avail themselves of the opportunity, we then apply to the court for an order to sell the same at public sale, for other purposes than for food, and the money so received is placed in the state treasury to the credit of the dairy and food commissioners' fund. Usually the matter in such cases ends there, as the parties are visited by our inspectors at frequent intervals afterwards, but it is seldom that a second seizure is necessary. Some of the parties who were in possession of a large supply at the time the seizures were made, caused the same to be replevined, and those cases are now pending. But in all cases where we find oleo has been placed on sale as butter or where it is sold at retail or the broken package, we have commenced proceedings at once. A number of such cases are now pending, and we have reason to believe that when these cases have been fairly tried, our laws will be fully sustained, and oleo can only be sold under the provisions of the inter-state commerce law, at least so far as this state is concerned.

OLEOMARGARINE CASES.

State of Minnesota vs. Frank Cox. In municipal court at Duluth, before Judge Powell. Warrant issued May 23, 1893; charged with the sale of oleomargarine for butter. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer. Bound over to the grand jury and indictment found; case pending before the district court at Duluth.

State of Minnesota vs. Mosher & Knittle. In municipal court at Duluth, before Judge Powell. Warrant issued May 23, 1893; defendants charged with having sold oleomargarine not colored pink as required by law. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer. Defendants appeared May 31st, plead guilty and were fined $50 and costs.

State of Minnesota vs. P. M. Garigon. In municipal court at Duluth, before Judge Powell. Warrant issued May 23, 1893; defendant charged with having sold oleomargarine not colored pink as required by law; taken from municipal court under habeas corpus proceedings to circuit court May 31, 1893, and there thrown out on the grounds of not being a criminal case; appeal was taken to October term of supreme court and order reversed; case now pending before district court at Duluth. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. Fred Weideman. In municipal court, Duluth, before Judge Powell. Warrant issued May 23, 1893; same charge as above. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer; same disposition as above case, still pending before circuit court at Duluth.

State of Minnesota vs. Emilie Constant. Warrant issued June, 1893; case tried in municipal court, St. Paul, before Judge Twohy, July 3, 1893; defendant charged with using oleomargarine at his hotel, not colored pink as required by law; case dismissed on account of illegality of warrant. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. N. Y. Restaurant. In municipal court, St. Paul, before Judge Twohy; warrant issued July 3, 1893; defendant charged same as above case. Witnesses, E. J. Graham, E. N. Eaton, chemist, and J. M. Bohrer. Case dismissed on account of illegality of warrant.

State of Minnesota vs. Walter J. Mears. Warrant issued July 7, 1893; in municipal court, Minneapolis; defendant charged with selling oleomargarine as butter; defendant appeared and was bound over to the grand jury of Hennepin county. Witnesses, H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer. Defendant since deceased, case dropped.

State of Minnesota vs. Owen Epply. In municipal court, Minneapolis, before Judge Mahoney; warrant issued July 7, 1893; sold oleomargarine as butter. Witnesses, H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer. Bound over to the grand jury, case pending.

State of Minnesota vs. W. W. Sewerly, in municipal court, Minneapolis. Warrant issued July 7, 1893; sold oleomargarine as butter; bound to the grand jury; case pending.

State of Minnesota vs. C. C. Mullen. In municipal court, Minneapolis; sold oleo as butter; warrant issued Sept. 20, 1893. Witnesses, H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer. Bound to grand jury; indictment found; case pending.

State of Minnesota vs. John Nelson, in municipal court, Minneapolis. Warrant issued September 20, 1893. Defendant sold oleomargarine as butter; bound to grand jury and indictment found; case pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. C. Connolly, in municipal court, Minneapolis. Warrant issued September 20, 1893. Sold oleomargarine as butter; bound over to grand jury and indictment found; case still pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. J. N. Davis, in municipal court, Minneapolis. Warrant issued September 20, 1893. Sold oleomargarine as butter; bound to the grand jury and indictment found; case still pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

State of Minnesota vs. Chas. Watson, in municipal court, Minneapolis. Warrant issued September 20, 1893. Sold oleomargarine as butter; bound to the grand jury and indictment found; case still pending. Witnesses: H. A. Hokemeier, E. N. Eaton, chemist, and J. M. Bohrer.

OLEO SEIZURES.

From J. P. Mattson, Minnesota and 5th street, St. Paul; seized by J. M. Bohrer and E. B. Williams, 1 package of rolls, marked "Kansas Dairy," in cold storage.

From Champion restaurant, 347 Minnesota St., St. Paul, 1 broken package, seized by Bohrer and Williams, placed in cold storage; "Kansas Dairy."

From A. Charboneau, corner Wabasha and 7th St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From American House, corner Wabasha and 4th St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From Dominick Spillman, 354 Minnesota St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From N. Y. Bridges, 414 Jackson St., St. Paul; 1 broken package "Kansas Dairy," seized by Bohrer and Williams, and placed in cold storage.

From T. Asbjornson, 200 2d St. S., Minneapolis; 1 broken package, seized by Bohrer and Williams; placed in cold storage.

From Henry Schmidt, corner 6th St. and Washington Ave., Minneapolis; three packages seized by Hokemeier and Wildt, and placed in cold storage.

From Willard M. Severy, 28 1st Ave. N., Minneapolis; two packages seized by Hokemeier and Wildt; placed in cold storage.

From John G. Swanson, 101 2d St. S., Minneapolis; seized two packages by Hokemeier and Wildt; placed in cold storage.

From P. G. Nelson, 129 2d St. N. Minneapolis; one package seized by Hokemeier and Wildt, and placed in cold storage.

From Joseph Hermann, 415 Rosabel St., St. Paul; 1 package seized by Hokemeier and Bohrer; placed in cold storage.

From J. G. Brandtberg, 223 E. 6th St., St. Paul; 1 package seized by Hokemeier and Bohrer; placed in cold storage.

From Emilie Constant, 260 E. 6th St., St. Paul; 1 package seized by Hokemeier and Bohrer; placed in cold storage.

From Mrs. Kraemer, No. 1600 2d St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. J. Fritz, "Union House," Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. McNally, 1613 2d St. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Martin Matson, 1818 Washington Ave. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Washington House," 214 Washington Ave., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From James McMakin, 206 Washington Ave., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Ames House," Camden Place, Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Eric Olson, 2329 2d St. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From A. Schrover, 317 Washington Ave. N., Minneapolis; 1 package seized by Davis and Bohrer and placed on cold storage.

From M. Weir, 1320 Washington Ave. N., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From City Lunch Room, 108 Washington Ave. S., Minneapolis; 1 package seized by Bohrer and Davis and placed in cold storage.

From John Clemon, 47 3d St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Richelieu House, 241 1st St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. Carlson, 815 3d St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. Jersdt, 249 Cedar St., Minneapolis; 1 package seized by Bohrer and Williams, and placed in cold storage.

From W. Anderson, 259 Cedar St., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Parker House," 13 1-2 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. Peter Olson, 216 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From "Grand Central Hotel," 1st St., Minneapolis; 2 jars seized by Bohrer and Davis, and same placed in cold storage.

From "Scandia House," 125 2d St. N., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "Skandia House," 200 2d St. S., Minneapolis; 2 packages seized by Bohrer and Davis, and same placed in cold storage.

From "Norman House," 223 2d St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From Matt Meyer, 30 1st St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From H. Bussi, 16 1st St. S., Minneapolis; 1 package, seized by Bohrer and Davis, and same placed in cold storage.

From "Brigham House," Minneapolis; 1 package, seized by Bohrer and Davis, and same placed in cold storage.

From "6th Ave. Hotel," 6th St. and Washington Ave., Minneapolis; 1 package, seized by Bohrer and Davis, and same in cold storage.

From "Foster House," 28 7th Ave. N., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "Brittania House," 213 1st St. N., Minneapolis; 2 packages seized by Bohrer and Davis, and placed in cold storage.

From Eliza Collins, 31 Central Ave., Minneapolis; 1 jar seized by Bohrer and Davis, and placed in cold storage.

From "Clifton House," 20 3d St., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From Mrs. Littlefield, 422 Central Ave., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "1st Ave. Hotel," 1st Ave. N. E. and 5th St., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From Mrs. J. A. Miles, 209 4th St. N., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "Progress" restaurant, 8 Washington Ave., Minneapolis; 1 package seized by Bohrer and Davis, and placed in cold storage.

From Mrs. C. F. Munger, 129 7th St. N., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From Gabriel Johnson, 1601 5th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "New Court House Restaurant," 310 4th St. S., Minneapolis; 1 jar seized by Bohrer and Davis, and same placed in cold storage.

From Mrs. Elsie Castofan, 1003 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and the same placed in cold storage.

From Andrew Heogh, 1325 4th St. S., Minneapolis; 1 package seized by Bohrer and Davis, and same placed in cold storage.

From "Rising Sun Hotel," 373 Rosabel St., St. Paul; 1 package seized by Bohrer and Hokemeier, and placed in cold storage.

From John P. Mattson, cor. 4th and Rosabel St., St. Paul; 1 package seized by Bohrer and Hokemeier, and placed in cold storage, 2d seizure.

From Kimbal & Hughes, 3d and Nicollet, Minneapolis; 1 package seized by Bohrer and Hokemeier, and placed in cold storage.

From Mrs. Goudy, 700 Hennepin Ave., Minneapolis; 1 package seized by Bohrer and Hokemeier, and place in cold storage.

From "Metropolitan Hotel," 628 Hennepin Ave., Minneapolis; 1 package seized by Bohrer and Hokemeier, and same placed in cold storage.

From Matt. L. Chartier, delivery wagon, Minneapolis; 13 packages seized by P. W. Wildt, inspector, and same placed in cold storage.

From "Railroad Eating House," Austin, Minnesota; 2 packages seized by E. J. Graham, assistant commissioner, and same placed in cold storage.

From J. H. Cole, Carleton, Minnesota; 1 package seized by E. J. Graham and H. A. Hokemeier, and same placed in cold storage.

From J. Wilky, Duluth, Minnesota; 36 packages seized by E. J. Graham and H. A. Hokemeier. The same was replevined by Wilky, case still unsettled.

From Simon Clark Grocery Co., Duluth, Minn.; 4 packages seized by E. J. Graham and H. A. Hokemeier, and same placed in cold storage.

From R. McCue, West Duluth, Minn.; 1 package seized by E. J. Graham and H. A. Hokemeier, and same placed in cold storage.

From St. Charles Hotel, West Duluth, Minn.; 1 package seized by Graham and H. A. Hokemeier, and same placed in cold storage.

From M. Brown, 2d St., West Duluth, Minn.; 1 package seized by Graham and H. A. Hokemeier, and same placed in cold storage.

From O. Olson, Skandinavian Hotel, West Duluth; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From Jos. Blake, West Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From M. Mathieson, 1st St. and 9th Ave., West Duluth; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From James Connors, West Duluth, Minn.; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From Gus Runquist, West Duluth; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From Winona House, Winona, Minn.; bought 3 pounds as and for butter; case to be prosecuted; Graham and Hokemeier.

From Merchants Hotel, Winona, Minn.; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From Sherwood House, Winona, Minn.; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From J. W. Cumming, Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From A. Lemay, Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From John Holberg, Duluth, Minn.; 1 package seized by Graham and Hokemeier, and placed in cold storage.

From A. Meyer, Duluth, Minn.; 1 package seized by Graham and Hokemeier, and same placed in cold storage.

From S. H. Reed, Duluth, Minn.; 1 package seized by Graham and Hokemeier and placed in cold storage.

From Matt Meyer, 30 1st St. S., Minneapolis; 1 package seized by Hokemeier and Davis, and placed in cold storage.

From Minneapolis Provision Co., Minneapolis; seized 273 packages, by Hokemeier and Davis; this was replevined by the Minneapolis Provision Co. November 4, 1893, and delivered to them by the sheriff; case to be tried January term of Hennepin county district court.

Newport House, Minneapolis; 2 packages seized by Hokemeier and Davis.

Mat Meyer, Minneapolis; 1 package seized by Hokemeier and Davis.

Scandia Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

Brittania House, Minneapolis; 1 package seized by Hokemeier and Davis.

New England Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

Newport House, Minneapolis; 1 package seized by Hokemeier and Davis.

Union House, Minneapolis; 1 package seized by Hokemeier and Davis.

"Bellevue House," Minneapolis; 1 package seized by Hokemeier and Davis.

A. E. Sylvester, Minneapolis; 1 package seized by Hokemeier and Davis.

C. W. Cowgell, Minneapolis; 1 package seized by Hokemeier and Davis.

Sixth Avenue Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

Eureka Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.

Flour City Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.

Ontario Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.

Hall Bros.' Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.

C. C. Miller, Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.

St. Leon Hotel, Minneapolis; 1 package seized by Hokemeier and Davis. Davis.

Hotel St. Angelo, Minneapolis; 1 package seized by Hokemeier and Davis.

Broadway House, Minneapolis; 1 package seized by Hokemeier and Davis.

Mrs. Olson, boarding house, Minneapolis; 1 package seized by Hokemeier and Davis.

Tremont House, Minneapolis; 3 packages seized by Hokemeier and Davis.

"Metropolitan Restaurant," Minneapolis; 1 package seized by Hokemeier and Davis.

St. Charles Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

Cedar Ave. Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

Upland Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

White House Cafe, Minneapolis; 1 package seized by Hokemeier and Davis.

Yerxa Bros. & Co., Minneapolis; 1 package seized by Hokemeier and Davis.

Orleans Hotel, Minneapolis; 1 package, seized by Hokemeier and Davis.

Casino Lunch Room, Minneapolis; 1 package seized by Hokemeier and Davis.

Matt Meyer, Minnesota House, Minneapolis; seized, 1 package by Hokemeier.

Henry Schmidt, 6th Ave. Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.

Columbia Restaurant, Minneapolis; 3 packages seized by Hokemeier and Davis.

Comique Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.

Miss Mary Doland, restaurant, Minneapolis; 2 packages seized by Hokemeier and Davis.

Martin Thompson, Minneapolis; 2 packages seized by Hokemeier and Davis.
Pullman House, Minneapolis; 1 package seized by Hokemeier and Davis.
St. James Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.
Comique Restaurant, Minneapolis; 1 package seized by Davis and Hokemeier.
P. Harrington, Minneapolis; 1 package seized by Hokemeier and Davis.
Mrs. W. Sheehy, Minneapolis; 1 package seized by Hokemeier and Davis.
F. C. Munger, Minneapolis; 1 package seized by Hokemeier and Davis.
C. H. Parrott, Minneapolis; seized, 1 package by Hokemeier and Davis.
Dominick Spillman, St. Paul; 1 package seized by Bohrer and Williams.
Gilbert's Restaurant, St. Paul; 1 package seized by Bohrer and Williams.
Fred Leuth, St. Paul; 1 package seized by Bohrer and Williams.
"One Minute Restaurant;" 1 package seized by Bohrer and Williams.
Grand Central Hotel. St. Cloud; 3 packages seized by Bertram and Wildt.
J. Peterson, Minneapolis; seized, 1 package by Hokemeier and Davis.
Flour City Restaurant, Minneapolis; 1 package seized by Hokemeier and Davis.
John Cummings, Minneapolis; 1 package seized by Hokemeier and Davis.
Mankato House, Minneapolis; 1 package seized by Hokemeier and Davis.
Mrs. B. Harra, Minneapolis; 1 package seized by Hokemeier and Davis.
Andrew Malin, Minneapolis; 1 package seized by Hokemeier and Davis.
Patrick Lally, Minneapolis; 1 package seized by Hokemeier and Davis.
Swan Bergquist, Minneapolis; 1 package seized by Hokemeier and Davis.
John Lundquist, Minneapolis; 1 package seized by Hokemeier and Davis.
C. C. Miller, Minneapolis; 1 package seized by Hokemeier and Davis.
J. Peterson, Minneapolis; 1 package seized by Hokemeier and Davis.
John Cummings, Minneapolis; 1 package seized by Hokemeier and Davis.
A. E. Manning, Minneapolis; 1 package seized by Hokemeier and Davis.
Kenwood Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.
Mrs. Errickson, Minneapolis; 1 package seized by Hokemeier and Davis.
Hotel Waverly, Minneapolis; 1 package seized by Hokemeier and Davis.
Mankato House, Minneapolis; 1 package seized by Hokemeier and Davis.
A. E. Ford, Minneapolis; 1 package seized by Hokemeier and Davis.
C. W. Cowgell, Minneapolis; 1 package seized by Hokemeier and Davis.
C. C. Miller, Minneapolis; 1 package seized by Hokemeier and Davis.
W. H. Semon, Minneapolis; 1 package seized by Hokemeier and Davis.
L. E. Reed, Minneapolis; 1 package seized by Hokemeier and Davis.
National Hotel, Minneapolis; 1 package seized by Hokemeier and Davis.
W. W. Brown, Minneapolis; 1 package seized by Hokemeier and Davis.
C. W. Cowgell, Minneapolis; 1 package seized by Hokemeier and Davis.

LARD.

The present condition of the lard market is not strictly in harmony with the wishes of this department. The law as it now stands allows "Lard Compound or Lard Substitute" (a combination of stearine, cottonseed oil, etc.) to be sold on the markets of the state under certain conditions, viz.: "That each package shall have firmly affixed upon it a label upon which is printed in letters of not less than one-half inch high, the words "Lard Compound" or "Adulterated Lard" and immediately following the same, in letters not smaller than long primer, the name and approximate proportions of the several constituents contained in the mixture or compound, and shall furnish the purchaser at the time of sale a card upon which is legibly printed the name of the article as hereinbefore defined, and a list of the several component parts of the mixture. Provided the conditions above stated are complied with, this article becomes recognized upon our markets as a legitimate product and will contest the field for a portion of the traffic that has been in the con trol of pure lard, and there is no article placed upon the market, however unhealthy or impure, but what will find a sale however limited that sale might be, but it is a fact beyond denial, that every pound of this compound sold, displaces just so much of the pure article, and the producer of pure foods has just one more enemy in the field with which to contend.

The conditions governing the lard market have materially changed within the past few years, especially is this the case regarding the source from which our merchants receive their supply. In former years the farmers of the state sold their pork dressed, and the farmers and local butchers rendered the lard and placed it upon the market strictly pure, but since the advent of the great slaughtering establishments of Chicago, Kansas City and other large cities, the bulk of the lard placed upon the market comes from these establishments. The farmers have now ceased slaughtering and have adopted the plan of shipping their hogs on foot, that source of supply has, therefore, been cut off and the consumer must rely mainly on the product of these establishments to furnish this necessary article.

It is not to be wondered at that substitutes are fast displacing the lard of commerce on our markets; the blame can justly be laid at the doors of the packing houses. It is only necessary to pay a visit to these rendering establishments, and see the reeking mass of filth from which "pure lard," "kettle rendered lard," "steam refined lard," etc., and the many other high sounding brands, are extracted from, the sight would forever wean a person from a desire to use lard in the preparation of food, even though it were ever so pure; these facts having been brought to the notice of the public, it is but natural that a substitute should be sought for.

At the last session of the Minnesota legislature an amendment to our present lard law was passed, whereby "cottolene" was excepted from the penalties provided for the sale of imitation lard. Cottolene is a combination of refined cotton-seed oil (a purely vegetable product) and selected beef suet, and is claimed by chemists and others to be perfectly healthy; however this may be, it is certainly preferable in view of its cleanliness, and it has become a recognized commodity on the markets of our state in the eyes of the law, and from our observation seems to be growing in favor. While this department is not recommending this product to the public, yet we are not in a position to condemn it without a more thorough investigation, and the production of more substantial proof than has yet been brought against it. It is an undeniable fact that many housewives of this country through prejudice, or a long continued use of lard cannot see any virtues in a substitute. This is but natural, and even though the lard of the present day contained no adulteration, the filthy manner in which it is produced has conspired to bring about the present condition of affairs. It is certainly a deplorable condition of circumstances, when a state of the importance of Minnesota, that raises many hundreds of thousands of hogs annually, that are shipped to markets outside of our state, and substitutes for lard are sent back for our use, thereby displacing a large amount of the genuine article, depriving consumers of the privilege of the use of an article of known purity and healthfulness, and one of the staples of our own production. It has been stated that the packing and slaughtering establishments utilize every portion of the hog with the bare exception of the squeal, and they are at present busy trying to find a use to which that may be put, that nothing can escape.

The time is certainly coming when it will be necessary for the general government to enact laws governing the adulteration of foods, and until such time arrives, the dairy and food departments of the various states will meet with more or less opposition in the enforcement of their local laws. The interstate commerce law has thus far proved a curse rather than a benefit to the farmer and dairyman, and will continue to be a menace until certain amendments are made to it, which it is sincerely to be hoped will occur soon.

BAKING POWDERS.

The baking powder market of this state was never in as good condition as at present. The law compelling all alum powders to be branded, "this baking powder contains alum," is very generally complied with, and it is only in isolated cases that the law is violated, and when such cases are detected and the attention of the merchant in whose possession it is found, is called to the fact, he either removes it from his shelves or causes the necessary label to be affixed. The merchants of our state are very desirous of placing none but pure goods on sale, and heartily co-operate with this department in their efforts to that end. For years past and until the dairy and food laws were enacted, the baking powder business offered a very lucrative field for those desiring to embark in a business that offered great returns for a small outlay; during those times the very cheapest alum and ammonia powders came into competition with the highest grade of cream of tartar powders. The cream of tartar powders had to be sold at a very close margin and often at a loss, while the common powders brought four times their actual worth, regardless of their unhealthy character. Heretofore, any article placed upon the market and labeled "baking powder" was bought by the consumer, without questioning the healthfulness or genuineness of the article, nor can this be wondered at, owing to the fact that the consumer never gave a thought regarding its component ingredients, so long as it performed its functions, nor was the attention of the general public attracted in this direction until after the food laws were enacted, and the investigations of eminent chemists made public. Then and not until then, did the consumer awaken to the true condition of things. Honest powders do not now come in competition with these cheap frauds. The law does not seek to drive the cheap powders from the markets, but only to compel these goods to be sold on their merits and for what they actually are, thereby allowing people, if they desire a cheap article, that privilege without being deceived.

This department has been annoyed on various occasions by the means resorted to by a certain baking powder firm (The Royal), in which through the medium of glaring advertisements that have appeared in most of the papers throughout the land, sought to convey the idea by implication to the public, that the Minnesota State Dairy and Food Department, had endorsed said Royal baking powder as the best powder made. We have repeatedly written to that firm and its agents, and also to the several newspapers in St. Paul and Minneapolis, forbidding each and all of them from using the name of the department in any of their testimonials, but without replying to us have persisted in so doing. It is a part of the policy of this department, to refuse the use of its name in the endorsement of any article of food within its jurisdiction. We will furnish parties a full analysis of any sample brought to us, and they may use such report as they see fit, but the consumer must draw his conclusions by comparison with that of other samples, and then we only vouch for the sample, and not for the commodity which that sample represents. We wish to say at this time that this department never said, or led the "Royal" people to believe that their powder was the best in the market. Our analysis of their goods would not bear out any such statement. It is not our desire to make war on said firm, or to try to injure their business in any way, but to warn the public that in all cases where the name of the Minnesota State Dairy and Food department is used as an endorser of the quality of said goods, or their superiority over others of the same class, that it is unauthorized and fraudulent. We have this to say regarding pure baking powders, that in our research among the baking powders on sale, that the purest and best powders found upon our markets are made in the state of Minnesota, and it gives the department great pleasure to be able to make this statement, and our loyalty to the state of Minnesota, and her young and growing industries should impel us to encourage the same. Nor is this the only reason, but also that if the goods are not found to be as represented, the party placing the same on the market is within reach of the strong arm of the law, and the purchaser has means of redress, which would be denied him if purchased from parties outside of the state.

Hon. Berndt Anderson, Dairy and Food Commissioner,

Sir: As requested I have determined the strength of the following brands of baking powder submitted to me:

The available gas is the nearest chemical estimation representing the carbon dioxid actually evolved in bread making; that is to say, the effective gas in culinary work.

The total gas is, as its name indicates, the entire amount of carbon dioxid capable of being set free in the powder. It includes not alone the gas liberated by cream of tartar but the gas-forming material present in the excess of sodium bicarbonate.

If the baking powder is slightly alkaline in reaction, the nearer the available gas approaches the total, other things being equal, the better the powder.

The cubic inches of gas at 212 degrees F. per ounce of powder is calculated from the available carbon dioxid.

Each determination was made in duplicate.

Brand.	Available CO_2	Total CO_2	Cu. in. per oz.
Dr. Price's Cream	13.46	14.05	161.78
Sugar of Milk	12.75	13.25	153.25
Royal	12.17	12.42	146.28
Snow Flake†	11.25	13.35	135.22
White Label*	10.22	10.28	122.84
T. & M.*	9.50	9.56	114.19
Fresh powder received from manufacturers—			
Sugar of Milk	14.53	14.85	174.65
Dr. Price's Cream	13.90	15.00	167.07

---

† Decidedly alkaline. * Neither acidn or alkaline.

It has been thought that a powder containing over 13 per cent of gas, which means less than 20 per cent of "fillers," would possess inferior keeping qualities. The strength of high grade baking powders now exceeds that figure, and it remains a matter of experiment whether or not these powders will readily deteriorate. It will be noticed that the powders procured on the market are of less strength than fresh samples received from the manufacturers. Experiments to settle this point are in progress and will be reported later.

Respectfully submitted,
E. N. EATON,
State Chemist.

REPORT OF ALUM BAKING POWDERS.

The following is a list of Alum Baking Powders found upon the Markets of the State and inspected by this Department:

Atlas—Reed, Murdock & Fisher, Chicago.
A. & P.—Atlantic & Pacific Tea Co., New York.
Austin's Choice—J. G. Fint, Milwaukee.
American—Geo. P. Vosbrink, Chicago, Ill.
Allison's—Allison Manufacturing Co., Janesville, Wis.
A. K.—Anthony Kelly & Co., Minneapolis.
Active—Bell, Conrad & Co., Chicago, Ill.
American Tea Co.'s Prize—American Tea Co., Minneapolis, Minn.
Bon-Bon—J. C. Grant Baking Powder Co., Chicago, Ill.
Berkey's True—Berkey, Talmadge & Co., St. Paul.
Big Can—Condell Manufacturing Co., St. Louis, Mo.
Big Bonanza—Allen, Moon & Co., St. Paul, Minn.
Brookman's—Brookman Baking Powder Co., Chicago, Ill.
Big Boom—E. J. Cotz, St. Louis, Mo.
Boston Baking Powder—Boston Baking Powder Co., Fairport, N. Y.
Century—Conrad, Bell & Co., Chicago, Ill.
Crystal—A. B. Gates & Co., Indianapolis, Ind.
Cream Puff—French, Palmer & French, Rochester, N. Y.
Corliss Baking Bowder—Corliss Baking Powder Co., Cincinnati.
City Mills—Kent & Brady, St. Paul, Minn.
Chicago Yeast Powder—Chapman & Smith, Chicago, Ill.
China—China Baking Powder Co., Chicago, Ill.
Chicago XXX—H. C. Fisher & Co., Chicago, Ill.
Cook's Choice—D. W. Payne & Co., Minneapolis.
Crystal—Phoenix Baking Powder Co.
China Tea House—China Tea House, St. Paul, Minn.
Cottage—Arctic Cracker & Spice Co., Minneapolis.
Challenge—Sherman Bros., Chicago, Ill.
Columbia—Columbia Baking Powder Co., St. Paul.

Capital—Ohio Coffee & Spice Co., Columbus, O.
Capitol—Dunham & Johnson, Minneapolis, Minn.
Crown—J. P. Dieter, Chillicothe, O.
Coin—B. J. Musser & Co., Chicago, Ill.
Crystal—Crystal Baking Powder Co., Chicago.
Calumet—Calumet Baking Powder Co., Chicago.
Cream Loaf—Smith & Coote, Duluth, Minn.
Daisy—Yanz, Griggs & Howes, St. Paul, Minn.
Diamond—Davis & Preston, Minneapolis, Minn.
Diamond Crystal—Pioneer Tea & Coffee Co., St. Paul, Minn.
Drady's—Drady, Moorhead, Minn.
Domestic—Domestic Baking Powder Co., Cincinnati, O.
Dr. Pierce's—Phoenix Baking Powder Co., Chicago, Ill.
Dew Drop—Arctic Cracker & Spice Co., Minneapolis, Minn.
Diamond—Diamond Baking Powder Co., Chicago.
Every Day—Bengal Coffee & Spice Co., Chicago, Ill.
Eddy's Baking Powder—Eddy & Eddy, St. Louis, Mo.
Eddy's Reliable—Eddy & Eddy, St. Louis, Mo.
Excelsior—
Electric Light—Joe N. Longenbach, Dorchester, Iowa.
Electric Light—M. A. Sherk, Mankato, Minn.
Eastlake—Minnesota Coffee & Spice Mills, St. Paul, Minn.
Empire—Craig Baking Powder Co., Cleveland, O.
Echo—Spencer & Co., Chicago, Ill.
Echo—Sherman Bros., Chicago, Ill.
Empire New Process—Empire Coffee £ Spice Mills, Minneapolis, Minn.
Empire—McCarthy, Cornelius & Co., St. Paul, Minn.
Eddy's Great Bargain—Eddy & Eddy, St. Louis, Mo.
Empire Silver Spoon—Empire Coffee & Spice Mills, Milwaukee.
Eclipse—Zipp & Schondorf, Cleveland.
Farina—New Process Baking Powder Co., New York.
Front Rank—F. J. Holmquist & Co., Minneapolis, Minn.
Fidelity—Sherman Bros., Chicago, Ill.
Fidelity Yeast—Sherman Bros., Chicago, Ill.
Forest City—Vonwie Bros., Cleveland, O.
Gates Baking Powder—Gates Baking Powder Co., Indianapolis, Ind.
Gates No. 1—A. B. Gates & Co., Indianapolis, Ind.
Golden Rule—Bell, Conrad & Co., Chicago, Ill.
Golden Rod—Boston Baking Powder Co., Chicago, Ill.
Gold Medal—Phoenix Baking Powder Co., Chicago, Ill.
Gold Dragon—Dean Bros. & Lincoln, Chicago, Ill.
Good as Gold—Ransom Bros., Albert Lea., Minn.
Goblet—Creelman & Avery, St. Paul, Minn.
Globe—Langham & Payne, Minneapolis, Minn.
Government—Columbia Baking Powder Co., St. Paul, Minn.
Government—Government Baking Powder Co., St. Paul, Minn.
Golden Rod—Dwinnell Hayward Co., Boston.
Gaylord—Crystal Baking Powder Co., Chicago.
Gold Coin—Langenbach, Williams & Co., Independence, Iowa.
Harries—Harries Baking Powder Co., Minneapolis, Minn.
Hard Pan—Chase & Pratt, Minneapolis, Minn.
Hatchet—W. M. Hoyt, Chicago, Ill.
Henkel's—Henkel Bros., Patterson, N. J.
Hotel—J. C. Grant Baking Powder Co., Chicago, Ill.
High Test—McCarthy & Camp, Minneapolis, Minn.
Home—Home Baking Powder Co., St. Paul, Minn.
Imperial—Merriam, Collins & Co., Chicago, Ill.
Ivory—Coronet Coffee & Spice Mills, Chillicothe, O.
Joe W. Langen Baking Powder—Joe W. Langen, Dorchester, Iowa.
Kenton—Potter, Parlin & Co., Cincinnati, O.
K. C.—F. F. Jaques, Kansas City, Mo.
Liberty—J. F. Wolf & Co., Pittsburg, Pa.
Lion—David Garrick & Co., Philadelphia, Pa.

Loyal— ——— ——— New York and Chicago.
Lightening—Dayton Spice Mills, Dayton, O.
Lone Star—Lone Star Manufacturing Co., Minneapolis, Minn.
Loman's Faultless—Sprague & Warner, Chicago.
Luxury—C. F. Meyer, Dayton, O.
Mammoth—Atwood & Steele, Chicago, Ill.
Magnolia—Magnolia B. P. Co., Chicago and St. Louis.
Mascott—C. F. Ware Coffee Co., Dayton, O.
Mrs. Baker's—Geo. R. Newell & Co., Minneapolis, Minn.
Mason's Pure Cream of Tartar—F. H. Mason & Co., Quincy, Ill.
Monarch Mills Yeast Powder—Reid, Murdock & Co., Chicago, Ill.
Morning Glory—St. Paul Baking Powder Co., St. Paul, Minn.
Milk Baking Powder—W. F. McLaughlin, Chicago, Ill.
Morning Lily—
Moss Rose—F. H. Mason & Co., Quincy, Ill.
Merchant Mills—Jewett Sherman Co., Milwaukee, Wis.
Minnesota—J. Marsen, St. Paul, Minn.
Mayflower—Vouwie Bros., Cleveland.
New Chicago—McNeil & Higgins Co., Chicago, Ill.
New Era—John Davis & Co., New York.
New England—Creelman & McCormack, St. Paul, Minn.
New Home—Mer. Co-Op. Chem. & Spice Co., Pipestone, Minn.
N. Y. Tea Co. Baking Powder—N. Y. Tea Co., New York.
North Star—North Star Baking Powder Co., St. Paul, Minn.
None Such—Geo. C. Hanford, Syracuse, N. Y.
Our Best—John A. Tolman & Co., Chicago, Ill.
Our Favorite—Our Favorite Baking Powder Co., New York.
Our Leader—Phoenix Baking Powder Co., Chicago, Ill.
One Pound—Globe Baking Powder Co., La Crosse, Wis.
O. K.—Rosewater Bros., Cleveland, O.
Old Abe—American Soda Co., Aurora, Ill.
Potters Best—Jewett Sherman, Chicago, Ill.
Pacific Tea Co—Kent & Brady.
Patapsco—Patapsco Baking Powder Co.
Palace— ——— ———, St. Paul, Minn.
Perfection—Smith & Chandler, Milwaukee, Wis.
Phoenix—Phoenix Baking Powder Co., Chicago, Ill.
Premium—Premium Baking Powder Co., New York.
Porter Bros.' Pure—Rosewater Bros., Cleveland, Ohio.
Postal—Spencer Blueing Paddle Co., Chicago., Ill.
Policy—H. C. Fisher, Chicago, Ill.
Putnam's Superior—Wells, Putnam & Co.
Puritan—Puritan Baking Powder Co., Cleveland, O.
Puhl's Prize Powder—Puhl & Webb, Chicago, Ill.
Purity—Home Baking Powder Co., St. Paul, Minn.
Pure Baking Powder—Burton Baking Powder Co., Fairport, N. Y.
Red Cross—Ricker, Crombie & McLean, Milwaukee, Wis.
Rising Sun—Phoenix Chemical Works, Chicago, Ill.
Rival—Twohy Bros. Mer. Co., West Superior, Wis.
Riverside Mills—Creelman, Avery & Co., St. Paul, Minn.
Riverside—Berkey, Talmadge & Co., St. Paul, Minn.
Red Star—Rodney Peckham, Milwaukee.
Spar—Spar Baking Powder Co., Chicago.
Safe and Reliable—Granger & Co., Buffalo, N. Y.
Standard—Globe Coffee & Spice Mills, Minneapolis, Minn.
State—Stuart & Snyder, Cleveland, Ohio.
Sovereign—Sovereign Baking Powder Co., New York.
Solar—Sherman Bros., Chicago., Ill.
St. Paul—St. Paul Grocery Co., St. Paul, Minn
Silver Star—E. Canby, Dayton, Ohio.
Silver Spoon—Arctic Cracker & Spice Co., Minneapolis, Minn.
Susag's Best—Susag Bros., Minneapolis, Minn.
Snow Ball—Bengal Coffee & Spice Co.

Snow Drift—Woolson Spice Co., Toledo Ohio.
Silver Standard—Deane Bros. & Lincoln, Chicago, Ill.
Silver King—Shaw & Thomas, New York.
Sweet Home—C. H. Blitchfeldt, Minneapolis, Minn.
Superior—O. Burke, St. Paul, Minn.
Spot Cash—J. C. Grant, Chicago, Ill.
Sun—Rosewater Bros., Cleveland, Ohio.
Swea—Rosewater Bros., Cleveland, Ohio.
Sweet Biscuit—Puhl & Webb, Chicago, Ill.
Schmidt's Favorite—Rosewater Bros., Cleveland. Ohio
The Model—Knoutz & Co., Faribault, Minn.
Town Talk—
Triumph—Harrison, Farrington & Co., Minneapolis, Minn.
The Legal—Rosewater Bros., Cleveland, Ohio.
Twin City—M'f'd for J. K. Ferguson, Minneapolis, Minn.
Taylor's Double Strength—Taylor Mfg. Co., St. Louis.
Union—Union Baking Powder Co., New York.
Union Star—Steele, Wedeles & Co., Chicago, Ill.
Underwood's—Thomas Wood & Co., Boston, Mass.
Unrivalled—Sprague, Warner & Co., Chicago, Ill.
Vienna—Consolidated Coffee Co., Omaha, Neb.
Victor—Reid, Murdoch & Fisher, Chicago, Ill.
Waseca—C. & C. Kirkpatrick, Waseca, Minn.
West—Jas. McIntosh & Co., Minneapolis, Minn.
Western Pearl—Western Pearl Co., Chicago, Ill.
Western Prince—Western Pearl Co.. Chicago, Ill.
West Hotel—McCarthy & Camp, Minneapolis, Minn.
Western—Jas. McIntosh & Co., Minneapolis, Minn.
White Rose—Geo. S. Freemy, Wheeling, W. Va.
White Rose—Chase & Pratt, Minneapolis, Minn.
White Lily—White Lily Baking Powder Co., St. Paul, Minn.
White Cross—J. Schneider & Co., Cleveland, Ohio.
Wisconsin—Ricker, Crombie & McLean, Milwaukee, Wis.
Windsor—A. C. Whitman, Jackson, Minn.
Yankee Baking Powder—Yankee Baking Powder Co., N. Y. and Chicago.
Yeast Powder—Chapman, Smith & Co., Milwaukee, Wis.
Zipp's Grape—Zipp & Schromdorser, Cleveland, Ohio.
Windsor—Edwin J. Gillis, New York.

VINEGAR.

Regarding the condition of the vinegar market, I will merely refer the reader to the report of the department chemist, that will appear later on. While our inspectors find occasional samples that are illegal on the markets, yet the supply is very good in quality. Some of the vinegars are slightly deficient in either acidity or solids, but their general character is what they purport to be, as designated by their brands. The "Alden" vinegar, celebrated for its spurious and illegal character, still leads the procession in that line as you will see by consulting the chemist table, but we are happy to state that very little is sold in our markets at the present time as the merchants of the state are "on to them," so to speak.

There are other vinegars which we would warn the merchants from buying until they have sent a sample of (4 ounces,) the same to this department for analysis, which will be given free of cost to any one in the state, viz.: Red wine vinegar, Amber vinegar, Malt vinegar, etc. The Red wine and Amber vinegars have been proven to be a low wine colored vinegar, and illegal on our markets. Some of the malt vinegars, placed upon our markets are White wine vinegars colored and malt extract added. This does not fulfill the requirements of the law, as a malt vinegar must be made direct from the malt, and the department will condemn any it may find that is not so made. The firm making the vinegar in which the extract has been used, has been notified that it is illegal, and must therefore find no fault when summary action is taken.

A case of poisoning at Excelsior last summer, where a number of persons were seriously poisoned, caused considerable excitement at that time, but fortunately no fatalities occurred. The cause of the unfortunate affair was traced to some vinegar sold at a certain store, and all who used of this vinegar were seriously affected. The vinegar in question was from a barrel manufactured by the Northwestern Vinegar Works of St. Paul, and sold a merchant at Excelsior. After the news of the poisoning reached the ears of this department, inspectors were immediately dispatched to Excelsior and samples taken from the vinegar yet in the hands of the parties where the poisoning occurred, and also from the barrel in possession of the merchant from whom it was obtained, and in every case large quantities of arsenic were found. We also procured some of the heavy sediment from the bottom of the barrel, and found it to be composed almost entirely of the arsenic of commerce. The department then made a thorough investigation of the vinegar on hand at the factory at the Northwestern Co., and also wherever the same was found on sale, and in every instance found it to be a legal vinegar, fully up to the requirements of the law, and free from any ingredients detrimental to the public health. How this particular barrel happened to contain such an amount of poison cannot be accounted for either by the manufacturer or the merchant who sold it, unless it was done by an enemy of either one or the other to accomplish revenge for some fancied wrong, but the department, after a thorough investigation, feels that no portion of the blame rests upon the manufacturer or seller, as they were as desirous of detecting the guilty party as were we. The amount of arsenic found in the bottom of the barrel and in solution, was estimated at about two pounds, enough to have depopulated the entire village, and it really seems an interposition of providence that no fatalities occurred.

In looking over the memoranda kept by our inspectors while visiting the various towns and villages on their tours of inspection, we are pleased to note that much the larger portion of vinegar sold in the state are Minnesota vinegars. The M. A. Gedney Pickling Co., the H. J. Heinz Pickling Co., the F. H. Spink & Co. Vinegar works and the Northwestern Vinegar works supply the greater part of the Minnesota vinegar, and their output is about in the order named. If the merchants of this state would consult their own interests and the interests of the state at large they would purchase their supplies at home where they could do equally as well. Suppose a merchant bought his goods at home and those goods failed to comply with the law, he would have redress on the manufacturer, and the loss would be made good. But if this department should discover unlawful goods in the hands of a merchant and such goods were obtained outside of the state, the merchant would be held responsible, and the manufacturer would escape on account of non-residence. At the time our present vinegar law went into effect we encountered a strong opposition from the numerous manufacturers, but since it has been thoroughly tested, and vinegars are sold under their true character these same manufacturers are our staunch friends.

While this department is strictly loyal to home industries, it also welsomes outside trade. But after much investigation on our part as to the quality of goods shipped into the state, we find a much greater proportion of that from the outside is inferior to our own product, and consequently we have no other recourse than to hold the purchasers responsible for the quality of the goods in their possession, which course we very much dislike to do, especially when the purchaser is innocent of any wrong intent. This rule holds good in other products as well as with vinegar. It not only places a better product upon the markets, but encourages home manufacture that tends to the upbuilding of the material interests of our state, which fact alone should be an incentive to every loyal citizen. Whatever tends to the advantage of our state inures to us as individuals and all parties are thereby indirectly benefited.

INSPECTION OF STABLES AND DAIRIES

Tributary to Minneapolis, and their condition, as reported by Inspectors, H. A. Hokemeier and C. B. Davis, from inspections made during February and March 1894.

Jensen & Peterson, 28th Ave. S. and 46th St.—Fourteen Cows; fairly clean; condition of stable, fair; creek water used.

Hansen & Co., 28th Ave. S.—Twenty-eight cows in good condition; surroundings, fairly clean; well water used.

Rasmusson & Crohon, 28th Ave. S.—Twenty-eight cows; in good health; stables and surroundings, fairly clean; well water.

Larson Bros., 28th Ave. S.—Cows in good health and condition; stable clean; well water.

Rosmanson & Bros.—Thirty-two cows; in good health and condition; stable, clean; well water.

S. Peterson, Cedar Ave. road—Thirty-one cows; in dirty condition; stable, dirty; cows lie in manure; well water.

Peter Benson, 47th St.—Twenty-eight cows; in dirty condition; stable, dirty; cows lie in manure; well water used.

L. H. Peterson, 48th St.—Twenty-nine cows; in dirty condition; stable, dirty; hogs kept in same stable; no bedding for cows; well water.

Rasmusson & Johnson, 48th St.—Twenty-one cows; in good health, but dirty; stable, dirty; no bedding used; well water.

Peterson Bros., 38th St.—Twenty-nine cows; clean and in good health; stable, well kept; well water used.

J. A. Will, 4010 Chicago Ave.—Cows, extra clean; barn, in good condition; bedding used; well water.

J. A. Jenson, 4010 Chicago Ave.—Twelve cows; in good condition; stable and cows clean and well cared for; well water.

Nels Mortenson, Chicago Ave.—Forty cows; clean and in good health; stable, in good condition; well water.

N. Anderson, Chicago Ave.—Fourteen cows; in good health and fairly clean; stable, fairly clean; well water.

H. C. Hanson, Chicago Ave.—Thirty-four cows; clean and in healthy condition; stable, clean; well water.

A. G. Carlson, Chicago Ave.—Twenty-eight cows; in fairly clean condition; stable and surroundings, fair; no bedding used; well water.

A. C. Peterson, Chicago Ave.—Forty-four cows; in fairly clean condition; stable and surroundings, in fairly clean condition; no bedding; well water.

Nelson & Hanson, Chicago Ave.—Twenty-four cows; in clean and healthy condition; stable and surroundings, clean; well water.

Sorenson & Christianson, Lake Amelia—Forty-five cows; in healthy condition, but poorly kept; stable, fairly clean; well water.

Johnson & Peterson, Lake Amelia—Twenty-seven cows; in good, healthy condition; stables and surroundings, clean; well water.

Jenson & Co., Lake Amelia—Thirty-six cows; in good health; cows in dirty condition; stable, dirty; well water.

H. L. Bartholomew, Richfield—Forty-three cows; in good health; cows and stable, in extra clean condition; well water.

M. H. Kelly, Portland Ave.—Nineteen cows; in healthy and fairly clean condition; stables, dirty; well water.

A. S. Peterson, Portland Ave.—Thirty-six cows; in clean, healthy condition; stables, fairly clean; well water.

S. Olson, Portland Ave.—Twenty-seven cows; clean and in good health; stable, fairly clean; well water.

J. L. Smith, Portland Ave.—Forty-six cows; in fair condition; stable, fairly well kept; well water.

Jacob Lohse, Portland Ave.—Thirty-five cows; in clean, healthy condition; stables, well kept; well water.

Nels Errickson, Portland Ave.—Thirty-six cows; clean and in good health; stables, well kept; well water.

Nels Errickson, Portland Ave.—Thirty-six cows; in clean, healthy condition; stables, clean; well water.

O. A. Dean, Nicollet Ave.—Twelve cows; in good health and fairly clean; stables, clean; well water.

S. P. Feulason, bet. Lyndale and Portland—Thirty-three cows; in healthy and fairly clean condition; stable, clean; well water.

Henry Bradbury, Portland Ave.—Thirty-three cows; in good health, but in dirty condition; stables, fairly clean; well water.

A. Doefler, Lyndale Ave.—Fourteen cows; in healthy and fairly clean condition; stables, clean; well water.

S. R. Thomas, Lyndale Ave.—Twenty-two cows; in good health and clean condition; stables, clean; well water.

C. H. Garvey, Lyndale Ave.—Thirty-five in good health; cows and stables, clean; well water.

A. M. Johnson, Lyndale Ave.—Twenty-seven cows; in good health and fairly clean; stables, clean; well water.

J. L. Jenkins, Lyndale Ave.—Thirty-seven cows; well water; cows, fairly clean; stable dirty and in bad condition; poor drainage; one sick cow.

E. F. Irwin, Lyndale Ave.—Forty cows; well water; cows, clean; stable, extra clean; cows in fine condition.

Frank Wilson, Lyndale Ave.—Thirty cows; well water; cows, clean; stable, extra clean; cows in fine condition.

A. Dill, Lyndale Ave.—Eight cows; well water; cows, clean; stable, clean; cows in good health.

Dean Richardson, Carroll Settlement—Fifteen cows; well water; cows, dirty; stable, fairly clean; cows in good health.

Charles Townsend, Carroll Settlement—Nine cows; well water; cows, dirty; stable, dirty; cows in fair health.

C. W. Day, Carroll Settlement—Thirteen cows; well water; cows, very dirty; stable, very dirty and poorly kept; no bedding used.

J. A. Johnson, Richfield—Eighty-five cows; well water; cows, very dirty; stable, very dirty; cows, not bedded; stable, poorly kept.

A. W. Johnson, Richfield—Thirty-seven cows; well water; cows, dirty; stable, fairly clean; cows not bedded.

J. H. Craik, Edina Mills—Twenty-nine cows; creek water; cows, clean; stable, clean; cows in good condition.

Cooper Bros., Edina Mills—Thirty-three cows; well water; cows, fairly clean; stable, clean; cows in good condition.

Johnson & Hansen, Edina Mills—Forty-five cows; well water; cows, clean; stable, clean; cows in fine order.

Frank Wilson, Edina Mills—eleven cows; well water; cows, fairly clean; stable, clean; stable, well kept.

J. A. Johnson, Edina—Forty-six cows; well water; milk tank, in stable; cows, dirty; stable, dirty; no bedding used.

George Cole, Edina—Eight cows; well water; cows, fairly clean; stable, clean; cows well bedded.

Anderson & Walstedt, Edina—Sixteen cows; well water; cows, clean; stable, clean; cows in good health.

C. H. Hanke, St. Louis Park—Fifty cows; well water; cows, dirty; stable, fairly clean; no bedding used.

S. D. Sewell, St. Louis Park—Fifty-five cows; well water; cows, fairly clean; stable clean; no bedidng used.

Anderson Brothers, St. Louis Park—Thirty-five cows; well water; cows, fairly clean; stable, fairly clean; cows bedded.

Christ Anderson, St. Louis Park—Thirty cows; well water; cows, fairly clean; stable fairly clean; cows in good health.

A. Samuelson, St. Louis Park—Twenty-nine cows; well water; cows, dirty; stable, fairly clean; no bedding used.

Holm & Thompson, St. Louis Park—Thirty-two cows; well water; cows, fairly clean; stable, fairly clean; cows in good health.

J. C. Johnson, St. Louis Park—Forty-seven cows; well water; cows, fairly clean; stable, clean; cows in good health.

H. G. Jacobson, Hopkins—Twenty-two cows; well water; milk tank, in stable; cows, dirty; stable, dirty; cows in good health.

A. Schimmel, Fort Road—Six cows; well water; cows, clean; stable, clean; surroundings, clean.

Elmer C. Wright, Fort Road—Nine cows; well water; cows, clean; stable, extra clean; cows in good health.

W. H. Wright, Fort Road—Ten cows; well water; cows, clean; stable, extra clean; cows in good health.

L. Dumgeson, 23d Ave. S.—Twenty-five cows; well water; cows, dirty; stable, fairly clean; cows in thin flesh.

Philip Adelman, 24th Ave. S.—Ten cows; well water; cows, fairly clean; stable, clean; cows in good health.

Peter Christensen, 24th Ave. S.—Eight cows; well water; cows, clean; stable, clean; cows in good flesh.

J. Bandholz, 26th Ave. S.—Twenty-six cows; well water; cows, fairly clean; stable, clean; cows in good health.

R. Johnson, 37th St. and 23d Ave. S.—Twelve cows; well water; cows, dirty; stable, dirty; cows in thin flesh.

Antone Jensen, 36th St. and 22d Ave. S.—Eighteen cows; well water; cows, clean; stable, fairly clean; cows in good health.

G. A. Monroe, 37th St. and 21st Ave. S.—Thirty-two cows; well water; cows, dirty; stable, dirty; cows, thin and poorly cared for; stable, in poor condition. Monroe arrested and bound over to the grand jury.

C. G. Anderson, 37th St. and 21st Ave. S.—Twenty-one cows; well water; cows, dirty; stable, fairly clean; two lame cows.

D. F. Hallit, 38th St. and 21st Ave. S.—Seventeen cows; well water; cows, dirty; stable, dirty; cows, lame and thin; generally in bad condition. Hallit arrested and bound over to the grand jury.

O. A. Nordberg, 42d St. and 21st Ave. S.—Forty-two cows; well water; cows, clean; stable, clean; cows in good health.

Ole Olson, 42d St. and 21st Ave. S.—Thirty-nine cows; well water; cows, clean; stable, clean; cows in good health and good flesh.

Nels Olson, 42d St. and 23d Ave. S.—Nineteen cows; well water; milk tank, in stable: cows clean; stable, clean; cows in good health.

H. C. Jensen, 42d St. and 23d Ave. S.—Eighteen cows; well water; milk tank, in stable; cows, clean; stable, clean; cows in good health.

C. Jensen, 42d St. and 28th Ave. S.—Fifteen cows; lake water; cows, dirty; stable, fairly clean; cows infected with vermin.

Christ Ewald, 28th Ave. S.—Forty cows; cows, clean; stable, clean; cows, in good health.

A. J. Johnson & Co., Hopkins—Forty-one cows; well water; cows, dirty; stable, fairly clean; cows in good health.

N. P. Peterson, Lake St. Road—Twenty-four cows, well water; cows, clean; stable, clean; cows, in good health.

S. Johnson, Minnesota Boulevard—Sixteen cows; well water; cows, clean; stable, clean; cows in good health.

J. J. Molestad, Old Motor Line Road—Thirty-five cows; well water; milk tank, in stable; cows, clean; stable, clean; cows in good health.

J. J. Holman, Cedar Lake Road—Ninety cows; well water; cows, clean; stable, clean; cows in good health.

Chas. J. Nelson, Cedar Lake Road—Twenty-eight cows; well water; cows, dirty; stable, dirty; cows not bedded and infected with vermin.

L. A. Engel, Cedar Lake Road—Forty cows; well water; milk tank, in stable; cows, clean; stable, clean; cows in good health.

Mr. Rey, Cedar Lake Road—Sixty cows; well water; cows, dirty; stable, fairly clean; cows in good health.

H. C. Johnson, Cedar Lake Road—Twenty cows; well water; cows, fairly clean; stable, clean; cows in good health.

A. Bussey, Cedar Lake Road—Eighteen cows; well water; cows, dirty; stable, dirty; no bedding used.

H. A. Kroohn, Cedar Lake Road—Twenty cows; well water; cows, dirty; stable, dirty; cows in good health.

Jens Olson, Cedar Lake Road—Twenty-two cows; well water; cows, clean; stable, clean; cows in good health.

Peterson & Sorenson, Cedar Lake Road—Twenty-two cows; well watered; cows, clean; stable, clean; cows in good health.

D. D. Sullivan, Cedar Lake Road—Twenty-eight cows; well water; cows, very dirty; stable, very dirty; cows not bedded and barn in poor condition.

Frank Molsen, Cedar Lake Road—Twenty-two cows; well water; cows, fairly clean; stable, clean; cows in good health.

P. Engvall, Cedar Lake Road—Twenty-six cows; well water; cows, clean; stable, clean; cows bedded.

J. N. Knorhn, Western Ave. Road—Twenty cows; spring water; cows, dirty; stable, very dirty;- no bedding used; stable in poor condition.

Thomas Goldrick, Western Ave.—Twelve cows, creek water; cows, fairly clean; stable, clean; cows in good health.

L. C. Nelson, Western Ave. Road—Twenty-six cows; well water; cows, dirty; stable, dirty; cows, not bedded; cruelly treated and kept in damp stable.

S. Harold, Western Ave. Road—Twenty cows; well water; cows, very dirty; stable, very dirty; cows not bedded and stable poorly kept.

L. Pierson, Western Ave. Road—Twenty cows; well water; cows, clean; stable, fairly clean; cows in good health.

Jordan Bros., 6th Ave. Road—Fifty-two cows; well water; cows, fairly clean; stable, fairly clean; cows in good health.

J. K. Wickman, Watertown Road—Twenty-two, cows; well water; cows, dirty; stable, surroundings dirty.

Peter Swanson, 6th Ave. Road—Nineteen cows; well water; cows, fairly clean; stable, fairly clean; cows in good health.

F. O. Lidstrom, 6th Ave. Road—Twenty-nine cows; well water; cows, fairly clean; stable, fairly clean; cows in good health.

K. C. Knudson, 6th Ave. Road—Twenty-seven cows; well water; cows, fairly clean; stable, fairly clean; no bedding used.

Madson & Knudson, 6th Ave. Road—Thirty cows; well water; cows, fairly clean; stable, fairly clean; cows not bedded.

J. E. Foss, 6th Ave. Road—Sixty cows; well water; cows, fairly clean; stables, fairly clean; cows not bedded and infected with vermin.

D. C. Covney, River Road—Sixty-five cows; well water; cows, extra clean; stable, extra clean; cows in good health.

Paul Peterson, River Road—Twenty-one cows; well water; milk tank, in stable; cows, clean; stable, clean; cows in good health.

S. A. Anderson, River Road—Thirty-eight cows; well water; cows, very dirty; stable, dirty; cows not bedded.

W. Quill, River Road—Thirty-two cows; well water; cows, clean; stable, clean; cows in good health.

Peterson & Newberg, Brooklyn—Twenty-six cows; creek water; cows clean; stable clean; stable well kept.

John Martin, Middle Road—Nineteen cows; well water; cows clean; stable extra clean; stable well kept by good system.

Hoisting Bros., Humboldt Ave.—Eighteen cows; creek water; cows fairly clean; stable fairly clean; cows in good health.

O. F. Chamberlain, Camden Place—Thirty-three cows; well water; cows dirty; stable fairly clean; cows in good health.

N. P. Broberg, Marshall St. Northeast—Twenty-six cows; well water; cows dirty; stable fairly clean; cows in good health.

A. W. Frederickson, Marshall St. Northeast—Eighteen cows; well water; cows clean; stable clean; cows in good health.

O. Gunberg, Fridley—Twenty-two cows; well water; cows fairly clean; stable fairly clean; cows in good health.

A. J. Rasenthal, Fridley Park—Forty-seven cows; well water; milk tank in stable; cows fairly clean; one cow sick.

Reidel & Nelson, Fridley Park—One hundred and nine cows; well water; model milk house with flowing water; cows extra clean; stable extra clean; cows in fine condition; stable well kept.

C. C. Hayes, Fridley—Twenty-five cows; well water; cows fairly clean; stables clean; cows in good health.

S. Knudson, Fridley—Twenty-four cows; well water; cows dirty;- stable fairly clean; cows in good health.

H. Christensen, Fridley—Twenty-four cows; well water; cows clean; stable clean; cows in good health.

H. Hawkins, Fridley—Twenty-five cows; well water; cows fairly clean; stable clean; cows infected with vermin; surroundings dirty.

Martin Davidson, Fridley—Twenty-three cows; well water; cows fairly clean; stable fairly clean; pigs kept in stable.

J. N. Hanson, Riverside Road—Eighteen cows; well water; cows clean; stable clean; cows in good health; surroundings clean.

A. G. Rosendal, 42d Ave. S.—Twenty-two cows; well water; cows fairly clean; stable fairly clean; cows in good health; surroundings clean.

A. Carlson, 42d Ave. and Lake St. S.—Twenty-four cows; well water; cows dirty; stable dirty; cows too crowded; stable poorly kept.

Nels N. Larson, Emerald Ave. and Lake St. S.—Eighteen cows; spring water; cows very dirty; stable very dirty; cows in thin flesh.

A. B. Oradsor, Emerald Ave. and 3d St. S.—Forty cows; spring water; cows fairly clean; stable fairly clean; cows in good health.

H. B. and N. Olson, Emerald Ave. and 34th St. S.—Thirty-four cows; well water; cows clean; stable clean; cows in good health.

Peteson Bros., Emerald Ave. and 34th St. S.—Twenty-seven cows; spring water; cows clean; stable clean; cows in good health.

A. G. Larson, 31st St. and 34th Ave. S.—Thirty-five cows; well water; stable fairly clean; cows poorly kept; no bedding used.

Peterson & Mattson, 31st St. and 34th Ave. S.—Thirty-seven cows; well water; stable very dirty; cows very dirty; pigs kept in stable; milk tank used for a duck pond.

C. Lyreen, 3119 Lake St. S.—Fifteen cows; well water; cows and stable fairly clean; feeds distillery slops.

O. Young, 2922 33d Ave. S.—Fourteen cows; well water; cows and stable dirty; stable poorly kept; no bedding used; feeds distillery slops.

O. Johnson, 2820 32d Ave. S.—Sixteen cows; well water; cows and stable dirty; stable poorly kept; no bedding used.

M. Lierson, 2818 31st Ave. S.—Eleven cows; well water; cows clean; stable fairly clean; surroundings clean.

Gust Hansen, 2808 31st Ave. S.—Seven cows; well water; cows dirty; stable fairly clean; surroundings clean.

M. Dietlifser, Minnehaha Ave.—Nineteen cows; well water; cows very dirty; stable very dirty; cows lousy; no bedding used.

Hanson & Nelson, Minnehaha Ave.—Thirty-seven cows; spring water; cows and stable dirty; cows lousy and poorly attended; no bedding used.

L. M. Gamalgaard, Fort Ave.—Twenty-five cows; well water; cows dirty; stable dirty; surroundings fair.

H. P. Hanson, Fort Ave.—Thirty-two cows; well water; cows dirty; stable dirty; surroundings fair.

Chas. A. Hoag, Fort Ave.—Eighteen cows; well water; cows clean; stable extra clean; surroundings clean.

J. Ream, Lyndale Ave. Road—Eight cows, well water; cows and stable clean; cows in good health.

Henry Kell, Lyndale Ave. Road—Ten cows; well water; cows and stable extra clean; cows in good health.

John Hoey, Lyndale Ave. Road—Four cows; well water; cows fairly clean; stable clean; cows in good health.

J. I. Dean, Lyndale Ave. Road—Eight cows; well water; cows and stable fairly clean; cows in good health.

Andrew Carlson, Bush Lake—Seven cows; well water; cows dirty; stable fairly clean; cows in good health.

Robert Roxbury, Bush Lake—Nine cows; well water; cows very dirty; stable fairly clean; cows in good health.

David Hoag, Penn Ave. Road—Twenty cows; well water; cows and stable fairly clean; pigs kept in stable.

Foss Brothers, Lyndale Ave. Road—Twenty-seven cows; well water; cows and stable fairly clean; cows in good health.

W. W. Bartholomew, Lyndale Ave. Road—Fifteen cows; well water; cows and stable clean; cows in good health.

John Goodspeed, Lyndale Ave. Road—Twelve cows, well water; cows and stable clean; cows in good health.

R. D. Fitch, Richfield—Eight cows; lake water; cows dirty; stable fairly clean; cows in good health.

L. Humphrey, Richfield—Fifteen cows; well water; cows dirty; stable fairly clean; cows in good health.

E. E. King, Penn Ave. Road—Thirty-eight cows; well water; milk tank in stable; cows fairly clean; stable clean; cows in good health.

A. S. Fitch, Penn Ave. Road—Eleven cows; well water; cows and stable clean; cows in good health.

James Ray, Penn Ave. Road—Eleven cows; well water; milk tank in stable dirty; stable fairly clean; cows lousy.

James Tierney, Penn Ave. Road—Seventeen cows; well water; cows and stable clean; cows in good health.

O. A. Anderson, Edina—Nineteen cows; well water; cows and stable extra clean; stable in very fine condition and well kept.

P. A. Graham, Richfield—Fifty-nine cows; lake water; cows very dirty; stable very dirty; cows poor; not bedded; fed sour malt; lie in manure; floor very uneven.

H. W. Richardson, Richfield—Thirteen cows; well water; cows fairly clean; stable clean; not bedded.

W. H. Lane, Edina—Six cows; well water; cows fairly clean; stable fairly clean; well bedded.

H. R. Stillman, Robbinsdale—Twenty-two cows; well water; cows dirty; stable fairly clean; no stanchions used; good system of tying cattle.

R. Hanson, Johnson Road—Twenty-seven cows; well water; cows and stable fairly clean; cows in good health.

Paul Wind, Johnson Road—Thirty-six cows; well water; cows and stable fairly clean; cows in good health.

P. O. Johnson, Johnson Road—Twenty-six cows; well water; cows and stable clean; cows in fine condition.

P. S. Miller, Johnson Road—Seventy cows; well water; cows and stable extra clean; cows well tended; stable well kept.

R. C. Moser, Johnson Road—Eighteen cows; well water; cows fairly clean; stable clean; cows in good health.

J. Kranz, Rockford Road—Twenty-eight cows; well water; cows dirty; stable fairly clean; no bedding used.

P. Behman, Crystal Lake—Thirty-three cows; well water; cows fairly clean; stable clean; cows in good health.

Matt Schuller, Crystal Lake—Twenty-eight cows; well water; cows fairly clean; stable fairly clean; cows in good health.

H. Schuller, Crystal Lake—Twenty-six cows; well water; cows fairly clean; stable fairly clean; cows in good health.

F. Baumgartner & Son, Crystal Lake—Thirty-two cows; well water; cows fairly clean; stable clean; cows in good health.

M. I. Johnson, Bass Lake Road—Thirty cows; well water; cows and stable clean; no stanchions used; good system of tying cattle.

L. Carlson, Bass Lake Road—Twenty cows; well water; cows dirty; stable fairly clean; cows in good health.

John Miller, Robbinsdale—Seventeen cows; well water; cows filthy; stable filthy; feeds vinegar slops; cows neglected; stable poorly kept.

Raarup & Anderson, Crystal Lake—Twenty-two cows; well water; cows clean; stable fairly clean; feeds vinegar slop.

L. H. Hoyt, Main Street N. E.—Fifty-five cows; well water; milk tank in stable; cows and stable dirty; no bedding used; stable in bad order.

H. M. Verrill, Maine St. N. E.—Twenty-one cows; well water; cows and stable clean; cows in good health.

J. S. Anderson, Fridley Park—Twenty-eight cows; lake water; cows and stable fairly clean; cows in good health.

Gus Lunde, Long Lake—Thirty-three cows; well water; cows and stable very dirty; no bedding used; cows neglected.

Nelson & Jackson, near Stock Yards—Thirty-seven cows; well water; cows and stable very dirty; cows poorly tended; stable in bad order.

P. Rasmussen, Central Ave. Road—Twenty cows; well water; cows dirty; stable fairly clean; no bedding used.

O. Hattron, Fridley Park—Twenty cows; well water; cows and stable fairly clean; cows in good health.

C. Cristoffer, Central Ave.—Thirty-seven cows; well water; cows fairly clean; stable fairly clean; cows in good health.

Mary Sorenson, Central Ave. Road—Eighteen cows; well water; cows and stable fairly clean; cows in good health.

J. F. Johnson, 2830 Central Ave.—Four cows; well water; cows and stable clean; cows in good health.

P. Christensen, 2838 Polk St. N. E.—Seventeen cows; well water; cows and stable fairly clean; cows lousy; stable in bad order.

C. E. Davis, 825 Twenty-eighth St. N. E.—Sixteen cows; well water; cows and stable clean; no stanchions use; good system of tying cows.

W. C. Wheeler, 2710 Taylor St. N. E.—Fourteen cows; well water; cows dirty; stable fairly clean; cows in good health.

R. Hanson, 2526 Washington St. N. E.—Eleven cows; well water; milk tank in stable; cows and stable fairly clean; cows in good health.

A. Pirie, 407 4 1-2 St. N. E.—Sixteen cows; spring water; milk kept in woodshed; bad order; cows and stable very dirty; cows poorly tended; stable foul; with very uneven floor.

O. Christensen, 2617 Johnson St. N. E.—Thirty-four cows; well water; dirty cows and stable; cows poorly tended and cruelly confined in a dirty stable with very uneven floor.

C. H. Buhman, Silver Lake Road—Eight cows; well water; cows fairly clean; stable dirty; cows lousy; not bedded.

Alfred Smiley, Silver Lake Road—Refused to answer any questions, inspectors ordered out of barn; Smiley arrested for resisting officers, convicted and fined $25.

S. Buxerman, Silver Lake Road—Six cows; well water; cows and stable dirty; surroundings dirty.

M. Greenstein, 32d and Dupont—Fifteen cows; lake water; cows dirty; stable dirty; one cow has caked back.

L. Kahn, 3101 Dupont Ave. N.—Twelve cows; well water; cows dirty; stables fairly clean; cows not bedded.

H. Klinkn, 36th Ave. N. and 9th St.—Fourteen cows; well water; cows dirty; stable dirty; cows not bedded; stable poorly kept.

Otto Swanson, 34th Ave. and James Ave. N.—Eight cows; well water; cows dirty; stable dirty; stable foul and wet.

Johnson & Sauling, 34th Ave. and 45th St. S.—Six cows; well water; cows dirty; stable dirty; no bedding used.

Pratt Brothers, Plymouth Ave.—Twenty-seven cows; creek water; cows dirty; stable fairly clean; surroundings clean.

Nordgren Bros., Watertown Road—Thirty cows; well water; cows fairly clean; stable fairly clean; surroundings clean.

Minneapolis Dairy Company, McNair Farm—Fifty-one cows; well water; cows clean; stable clean; no bedding used; surroundings clean.

Turner Bros., Watertown Road—Thirty-two cows; creek water; cows extra clean; stable extra clean; good system.

P. E. Neilson, Watertown Road—Forty-six cows; creek water; cows clean; stable dirty; surroundings fair.

Chris Neilson, Watertown Road—Fifty cows; creek water; cows fairly clean; stable clean; surroundings fair.

N. L. Anderson, Watertown Road—Thirty-seven cows; well water; cows clean; stable clean; cows in good health.

J. H. Miller, Watertown Road—Twenty-four cows; creek water; cows fairly clean; stable dirty; one cow with caked back; surroundings dirty.

P. Anderson, Golden Valley—Six cows; well water; cows extra clean; stable clean; cows well treated.

John Nelson, Watertown Road—Fourteen cows; well water; cows dirty; stable dirty; cows infected with vermin.

C. Varner, Watertown Road—Thirty cows; well water; cows clean; stable clean; one cow with caked back.

A. Anderson, Watertown Road—Twenty-seven cows; well water; cows extra clean; stable extra clean; cows not bedded.

Mrs. David Howland, Medicine Lake—Thirty-two cows; well water; cows fairly clean; stable fairly clean; surroundings fair.

Erickson Bros., Golden Valley—Two cows; well water; cows fairly clean; stable clean; surroundings fair.

S. M. Parker, Robbinsdale—Nine cows; well water; cows dirty; stable fairly clean; surroundings fair.

F. B. Philbrook, Silver Lake Road—Thirty cows; well water; stable dirty; cows fairly clean; no bedding used.

B. W. Higgins, Silver Lake Road—Sixty-nine cows; well water; cows and stable clean; cows in good health.

J. W. Peterson, Silver Lake Road—Fifteen cows; lake water; cows fairly clean; stable clean; cows in good health.

Olaf Foss, Silver Lake Road—Twenty-seven cows; well water; cows fairly clean; stable clean; cows in good health.

John Peterson, Silver Lake Road—Sixteen cows; well water; cows dirty; stable fairly clean; cows lousy.

S. Kuenze, Long Lake Road—Seventeen cows; well water; cows slightly dirty; stable new; surroundings fair.

Olson & Christianson, Long Lake Road—Seventy-four cows; well water; cows and stable clean; cows in good health.

D. McCullom, Long Lake Road—One hundred and twenty cows; well water; cows and stable clean; cows in good health and flesh.

Fred Wyatt, Long Lake Road—Seven cows; well water; cows fairly clean; stable clean; cows in good health.

J. B. Ansnes, Long Lake Road—Twenty-nine cows; well water; cows and stable fairly clean; cows lousy.

Stephen Bilthouer—Seven cows; well water; cows and stable clean; cows in good health.

H. Gaul, 801 Broadway N. E.—Twenty cows; well water; cows dirty; stable fairly clean; cows poorly kept.

Edward Trosseth, 1516 Buchanan St. N. E.—Twenty-five cows; well water; cows dirty; stable fairly clean; no stanchions used; good system of tying cows.

C. Everson, 1715 Buchanan St. N. E.—Eleven cows; well water; cows fairly clean; stable clean; no stanchions used; no system of tying cows.

Knute Lee, 1929 18th Ave. N E.—Twelve cows; well water; stable and cows extra clean; cows well tended and in fine condition.

McVeigh & Gibbons, 1909 "A" St. N. E.—Thirteen cows; well water; cows very dirty; stable new; cows poorly tended.

S. Swanson, 22d Ave. N. E.—Fourteen cows; well water; stable and cows clean; cows in good health.

Charles Bauman, Long Lake Road—Twenty-six cows; lake water; cows and stable clean; cows in good health.

John Schacht, Lake Johanna Road—Five cows; lake water; cows fairly clean; stable clean; cows in good health.

F. Peterson, Broadway Road—Thirty-five cows; well water; cows and stable extra clean; cows in good health.

Rasmussen Bros., Broadway—Thirty-five cows; well water; cows and stable clean; cows in good health.

E. Cooley, 22d Ave. N. E.—Seventy-one cows; well water; cows and stable fairly clean; surroundings fair.

C. E. Hall, 729 16th Ave. S. E.—Twenty cows; well water; cows filthy; stable very filthy; cows too crowded in a cold, leaky shed.

C. C. Fordice, 309 Buchanan St. N. E.—Four cows; well water; cows fairly clean; stable dirty; cows cruelly confined on an uneven floor.

W. M. Corbett, Aurora Park—Forty-two cows; well water; cows dirty; stable fairly clean; good system of tying cows.

H. J. Christensen, Como Ave. S. E.—Forty-four cows; well water; cows and stable clean; cows in good health.

John Peterson, Como Ave. S. E.—Fifty-four cows; well water; cows and stable clean; cows in good health.

P. Hanson, Como Ave.—Twenty-two cows; well water; cows and stable clean; cows in good health.

N. G. Skarman, Como Ave.—Eight cows; well water; cows and stable clean; cows in good health.

Chris Peterson, Cleveland Ave.—Thirty cows; well water; cows and stable clean; cows in good health.

E. J. Johnson, University Ave.—Thirty-two cows; well water; cows fairly clean; stable dirty; barn low and crowded.

Nels Jepson, University Ave.—Seven cows; well water; cows dirty; barn fairly clean; cows healthy.

Glennan & McGraw, St. Anthony Ave.—Twenty-four cows; spring water; cows and stable dirty; stable poorly kept with uneven floor.

Alexander & Shepard, Short-Line Bridge—Twenty cows; spring water; cows and stable extra clean; cows well tended and healthy.

Noodle & Son, Short-Line Bridge—Forty cows; spring water; cows and stable extra clean; cows well tended and in good health.

H. P. Peterson, Short-Line Bridge—Five cows; spring water; cows very dirty; stable fairly clean; surroundings fair.

M. G. Hanson, 36th Ave. and 2d St. S. E.—Thirty-one cows; well water; cows and stable clean; cows in good health.

John Mahon, 14th Ave. and 44th St. S.—Fourteen cows; well water; cows very dirty; stable very dirty and no bedding.

Anderson & Nelson, 17th Ave. and 37th St. S.—Twenty-two cows; well water; cows and stable clean; cows in good health.

W. Widen, 19th Ave. and 37th St.—Twenty-five cows; well water; cows fairly clean; stable clean; cows in good health.

Nels Hanson, 28th Ave. and 38th St. S.—Sixteen cows; well water; cows and stable fairly clean; cows in good health.

C. A. Eckberg, 21st Ave. and 26th St. S.—Four cows; well water; cows and stable extra clean; cows bedded and in good health.

John Anderson, 2131 3d St. S.—Ten cows; well water; cows very filthy; stable very filthy; no bedding used; stable neglected; feed distillery slops.

Nick Therris, 1310 2d St. N. E.—Seventeen cows; well water; cows dirty; stable fairly clean; no bedding used.

A. G. Hulmlund, 425 Southeast Flats.—Three cows; well water; cows and stable fairly clean; cows in good health.

J. Elion, 213 8th Ave. N.—Seven cows; well water; cows and stable dirty; surroundings fair; cows in good health.

Inspection of stables and dairies tributary to St. Paul. By Assistant Commissioner E. J. Graham and Inspectors Williams and Bohrer during April, 1893.

A. E. Swanson, Searles and Pine Sts.—Twenty cows; in good condition; barn fair; ventilation good; feeds bran, shorts and clover hay; pond water.

H. Clausen, Greenbrier and Denny Sts.—Nineteen cows; in good condition; poor stable and ventilation; cows dirty; feeds bran, ground feed and wild hay.

J. T. Johnson, 1457 Edgerton St.—Ten cows; in fair condition; barn and ventilation fair; feeds cockle, bran and clover hay; lake water.

M. Johnson, Casey and Edgerton Sts.—Thirty-one cows in good condition; stable and ventilation extra good; feeds cockle, bran, clover and timothy hay; well water.

A. Danberg, 1561 Edgerton St.—Sixty cows; in extra good condition; stable and ventilation extra good; feeds cockle, bran. timothy and clover hay; well water.

A. G. Peterson, Jesse and Edgerton Sts.—Twenty cows; in clean condition; barn and ventilation fair; feeds corn meal, bran and clover hay; well water.

T. Torgerson, Jesse and Edgerton Sts.—Seventeen cows; in good conditon; barn and ventilation good; feeds cockle, bran, shorts, clover and timothy hay; well water.

Chas. Jacobson, Edgerton and Jesse Sts.—Thirteen cows; in extra good condition; stable and ventilation good; feeds shorts, malt and clover hay; well water.

Fred Hersig, Old Canada Road—Twenty-six cows; in clean condition; stable and ventilation good; feeds malt, ground feed, clover and timothy hay; well water.

L. Pinska, Lake Gervais—Twenty-six cows; in good condition; stable and ventilation good; feeds ground screenings, clover and timothy hay; lake water.

F. Pinska, Lake Gervais—Thirty-nine cows; in good condition; barn and ventilation fair; feeds bran, ground feed; cornfodder and clover hay; lake water.

James Claus, Lake Gervais—Seventeen cows; in extra good condition; barn and ventilation fair—feeds bran, ground feed, cornfodder and clover hay; lake water.

C. S. Graham, Minneapolis and Edgerton Sts.—Twelve cows; thin in flesh; stable and ventilation good; feeds bran and wild hay; lake water.

Wm. Schuette, Arkwright St.—Twelve cows; in good condition; stable and ventilation fair; feed shorts and clover hay (sour feed); spring water.

J. Christianson, Garry St.—Eight cows; in good condition; stable and ventilaton fair; feed malt, shorts, cockle and red top hay; well water.

J. Griebowski, Garry and Adolph Sts.—Fourteen cows; in good condition; stable and ventilation good; feed ground feed, bran, clover hay; well water.

John Gobely, Oliver St.—Twenty-one cows; in good flesh; stable and ventilation good; feed cockle, shorts and clover hay; cows dirty; well water.

Josef Biark, Oliver St.—Twenty-seven cows; in good condition; stable and ventilation good; feed malt, bran, shorts and clover hay; well water.

Paul Spregl, Oliver St.—Fourteen cows; in good condition; stable and ventilation fair; feed malt, bran, shorts and clover hay; well water.

John Olson, De Soto St.—Thirty-nine cows; in good flesh, but dirty; good stable and ventilation; feed cockle, shorts and clover hay; well water.

Hugh Montgomery, Arkwright St.—Ninety-three cows; in extra good condition; stable and ventilation extra good; feed bran, corn meal and clover hay; well water.

B. M. Pierce, De Soto and Brant Sts.—Fifteen cows; in good condition; stable and ventilation good; feed bran, shorts, corn and clover hay; well water.

L. Errickson, Courtlandt St.—Six cows; in good condition; stable and ventilation fair; feed oil meal, shorts (feed sour), clover hay; cistern water.

D. Benecke, Albemarle St.—Nine cows; in extra good condition; stable and ventilation extra good; feed bran, shorts and clover hay; well water.

O. Feusberg, Woodbridge St.—Seven cows; extra good and clean; stable and ventilation good; feed shorts, bran and clover hay. Well water.

H. Lauer, Cottage St.—Twelve cows; in good condition; stable and ventilation bad; feed bran, shorts and timothy; well and pond water.

John Hollanitsch, Marion St.—Eleven cows; in good condition; stable and ventilation; feed millet, fodder, shorts and ground feed; well water.

Herman Freutel, Matilda St.—Thirty-two cows; in fair condition; stables and ventilation good; feed bran, ground feed and clover hay; well water.

Henry Freutel, Cottage and Matilda St.—Seventeen cows; in good condition; stables and ventilation good; feed bran, ground feed, clover hay; well water.

J. Baumann, Rice St.—Seven cows; in good condition; stables and ventilation fair; feed malt, bran, shorts and clover hay; well water.

Anton Thom, Woodbridge St.—Sixteen cows; in good condition; stable and ventilation good; feed bran, shorts and clover hay; well water.

Mark Thom, Woodbridge St.—Seven cows; in good condition; stable and ventilation poor; feed ground feed and clover hay; water from creek.

T. Schlozer, Rice St.—Twenty-one cows; in extra condition; stable and ventilation extra good; feed ground feed and clover hay; water from creek.

F. Seiberlich, Rice St., out—Thirteen cows; in extra good condition; stable and ventilation good; feed shorts, bran, cornfodder; well water.

Wm. Dohmen, Rice St., out—Twenty-three cows; in good condition; good stable; no ventilation; feed malt, bran and clover hay; well water.

F. Unfried, Rice St., out—Ten cows; in good condition; stable and ventilation fair; feed shorts and timothy hay; well water.

P. Peterson, New Canada—Seventeen cows; in good condition; stable and ventilation good; feed shorts, timothy and red top hay; well water.

A. Richtel, New Canada—Fifteen cows; in good condition; stable and ventilation fair; feed malt, bran, shorts and clover hay; well water.

Ed Seiberlich, New Canada—Sixteen cows; in good condition; stable and ventilation good; feed rye, shorts, fodder and clover hay; well water.

Chas. Seiberlich, New Canada—Twenty-eight cows; in good condition; stable good; ventilation extra good; feed bran, shorts and clover hay; well water.

J. Jackson, Lake Como—Twenty-four cows; in good condition; stable and ventilation fair; feed flour and timothy hay; well and lake water.

A. Abell, McCarron Lake—Fifteen cows; fair condition; good stable and ventilation; feed corn meal, roots and timothy hay; well water.

A. McCarron, McCarron Lake—Thirty-nine cows; in fair condition; stable and ventilation good; feed corn meal, roots, fodder and timothy hay; well water.

H. Schroeder, Rice St. and New Canada—Sixty cows; in extra clean and good condition; stable and ventilation extra good; feed flour, shorts, bran. timothy and clover hay; well water.

M. Strantz, New Canada—Fourteen cows; in good condition; stable and ventilation extra good; feed bran, shorts, wild and clover hay; well water.

Geo. & J. Nadeau, New Canada—Fourteen cows; in good condition; stable and ventilation fair; feed bran, shorts and clover hay; spring and lake water.

E. Knowlan, Rosetown—Twenty-nine cows; in good condition; extra good stable and ventilation; feed corn meal, bran, timothy and fodder; well water.

Karl Rudiger, Grotto and Carbon St.—Sixteen cows; in poor condition; barn and ventilation poor; feed bran, shorts, timothy hay; well water.

Heubschir Bros., Gaultier and Carbon Sts.—Twenty-eight cows; in fair condition; poor barn and ventilation; feed bran, oats and clover hay; well water.

August Mundt, Farrington Ave.—Fourteen cows; in good condition; stable and ventilation good; feed corn, bran and shorts and timothy hay; well water.

D. Kuhn, Farrington Ave.—Four cows; in extra good condition; stable and ventilation good; feed shorts and clover hay; well water.

Chas. Kelair, Dale and Farrington Sts.—Ten cows; in good condition; stable and ventilation good; feed bran and timothy hay; well water.

Gus Bothke, St. Albans and South St.—Fourteen cows; in good condition; stable good; ventilation poor; feed flour, bran and wild hay; well water.

J. Bergmann, St. Albans St.—Eighteen cows; in good condition; stable fair; ventilation poor; feed bran, shorts and clover hay; well water.

Wm. Schieneider, Rice St., out—Ten cows; in good condition; stable and ventilation good; feed bran, shorts and timothy hay; well water.

Fred Wendt, Rice St., out—Eighteen cows; in good condition; stable and ventilation good; feed bran, shorts and clover hay; well water.

Frank Tschida, Rice St., out—Fourteen cows; in good condition; good stable; fair ventilation; feed shorts and clover hay; well water.

J. A. Johnson, Lincoln Ave.—Ten cows; in good condition; stable and ventilation bad; feed corn, bran, shorts and clover hay; well water.

John Johnson, Grand Ave.—Twenty-one cows; in extra good condition; good stable and ventilation; feed corn meal, bran and clover hay; well water.

C. W. French, St. Clair St.—Thirty-two cows; in good condition; stable and ventilation good; feed rye, shorts, oil meal; clover hay; spring water.

M. J. Dunn, Brimhall Ave.—Twelve cows; in good condition; stable and ventilation good; feed vinegar waste, bran and millet; well water.

Wm. Rixmun, Hartford Ave.—Nine cows; in good condition; stable and ventilation poor; feed bran, shorts and wild hay; well water.

H. Lorenzo, Otto St.—Three cows; in good condition; good stable; fair ventilation; feed malt, shorts, wild hay; well water.

P. J. Keogh, Hamline Ave.—Forty-five cows; in good condition; good stable and ventilation; feed screenings, shorts, wild hay; well water.

Gus Schmidt, Cleveland Ave.—Nineteen cows; in good condition; stable fair; ventilation poor; feed screenings, shorts, wild hay; spring water.

D. J. Luby, Montreal Ave.—Fourteen cows; in good condition; good stable; fair ventilation; feed vinegar waste, timothy and millet; well water.

Mooney Bros., Montreal Ave.—Twenty-five cows; in good condition; stable and ventilation extra good; feed malt, shorts and wild hay; well water.

Bragg Bros., Montreal Ave.—Ninety cows; in good condition; good barn and ventilation; feed shorts, ground feed and wild hay; well water.

Gus Peterson, Montreal Ave.—Twenty-three cows; in good condition; poor barn and ventilation; feed shorts, ground feed, wild hay; well water.

A. Behland, Montreal Ave.—Three cows; in good condition; good stable; fair ventilation; feed bran, shorts and wild hay; well water.

Luther Dahl, Madison and W. 7th Sts.—Forty-eight cows; in good condition; good barn; fair ventilation; feed shorts, corn meal and wild hay; spring water

A. Fleegal, W. 7th St., out—Twelve cows; in good condition; stable and ventilation poor; feed sour vinegar waste, clover hay; river water.

Q. McCue, W. 7th St.—Twelve cows; in fair condition; poor barn and ventilation; feed vinegar waste and wild hay; spring water.

S. Stutzenneggen, Stewart Ave.—Fifteen cows; in good condition; good barn and ventilation; feed malt, bran and wild hay.

Bergman Bros., 1994 W. 7th St.—Ten cows; in extra good condition; stable extra good; ventilation good; feed bran, shorts and clover hay; well water.

J. W. Smith, W. 7th St.—Thirty-three cows; in good condition; barn and ventilation good; feed malt, bran and wild hay; well and spring water.

T. F. Smith, W. 7th St.—Twenty-three cows; in good condition; stable good; ventilation poor; feed flour, ground feed, fodder, timothy hay; creek water.

J. W. Jackson, W. 7th St.—Fifty cows; in extra good condition; stable and ventilation extra good; feed flour, ground feed and upland hay; river water.

Chas. Sattler, near Shot Tower—Twenty-two cows; in good condition; stable and ventilation fair; feed bran, shorts and wild hay; pond water.

W. Hampel, 980 Otto St.—Eleven cows; in good condition; stable and ventilation fair; feed bran, shorts and wild hay; pond water.

John Zinell, Butternut St.—Five cows; in good condition; barn and ventilation poor; feed vinegar waste, oil cake, upland hay; well water.

Geo. Poulicis, Stewart Ave.—Five cows; in good conditon; stable and ventilation poor; feed malt, shorts and timothy hay; well water.

T. Ellen, Stewart Ave.—Sixteen cows; thin but clean; fair barn and ventilation; feed vinegar waste, bran, wild hay; well water.

M. Booth, Ridgewood—Eight cows; good condition; fair barn; poor ventilation; feed vinegar waste, shorts, wild hay; spring water.

John Bayliss, Fairmont Ave.—Nineteen cows; good condition; good stable; poor ventilation; feed bran, shorts, wild hay; well water.

E. M. Johnson, Lexington and Fuller—Ninety cows; in good condition; extra good stable and ventilation; feed corn meal, shorts, wild hay; well water.

J. Duncanson, Annapolis St.—Six cows; in good condition; stable and ventilation good; feed screenings, shorts and timothy; well water.

Mrs. Reding, Dodd and Central Ave.—Twenty cows; in good condition; stable and ventilation fair; feed bran, shorts and timothy hay; spring water.

A. C. Staples, Dodd Road, out—Sixteen cows; in extra fine condition; stable and ventilation extra good; feed bran, corn meal and clover; well water.

M. Cleary, Dodd Road—Fifteen cows; in good condition; barn and ventilation good; feed corn meal, bran, clover hay; well water.

G. F. Jackson, 712 Hyacinth St.—Fifteen cows; in good condition; stable and ventilation good; feed ground feed, bran, tame hay; well water.

Robt. Bryant, Arcade St.—Forty-six cows; in extra good condition; stable and ventilation good; feed ground feed, bran, clover hay; well water.

John Batten Little, Lake Phalen—Three cows; in bad condition; surroundings very bad.

Philip Pfeiffer, 857 Hawthorne St.—Ten cows; in good condition; barn and ventilation good; feed ground feed and clover hay; well water.

Chas. Gastafson, 957 Rose St.—Ten cows; in good condition; barn and ventilation good; feed corn meal, oilcake and clover hay; well water.

Frank Johnson, 955 Rose St.—Six cows; in good condition; stable and ventilation good; feed meal, oil cake, bran, clover hay; well water.

John Sakrison, 968 Maryland St.—Four cows; in good condition; stable and ventilation poor; feed meal, oil cake and clover hay; well water.

Lars Anderson, 981 Rose St.—Twenty-five cows; in good condition; stable and ventilation good; feed meal, oil cake and clover hay; well water.

Andrew Anderson, cor. Payne and Minnehaha—Twenty cows; in good condition; stable and ventilation good; feed meal, oil cake and clover hay; lake water.

P. Parson, Gladstone—Twenty cows; in good condition; stable good; ventilation poor; feed bran, shorts, clover hay; lake water.

B. Dixson, Gladstone—Nineteen cows; in good condition; barn and ventilation good; feed bran, shorts and timothy hay; well water.

Henry Huffmeier, Hazel Park—Thirty-two cows; in good condition; barn and ventilation extra good; feed bran, shorts and timothy hay; well water.

Jacob Haney, E. 7th St.—Sixteen cows; in good condition; stable and ventilation good; feed bran, shorts and timothy hay; well water.

H. Radout, 123 Annapolis St.—Seven cows; in good condition; stable and ventilation good; feed bran, shorts and wild hay; well water.

Hammermeister Bros., Stickney St.—Forty-two cows; in good condition; stable and ventilation good; feed vinegar waste, bran, clover hay; spring water.

Inspection of stables and dairies tributary to St. Paul performed by Assistant Commissioner E. J. Graham and Inspectors Williams and Bohrer during February and March, 1894.

Henry Schrimpton—Forty-two cows; in good condition; stable and ventilation good; feed malt, clover and timothy hay; spring water.

T. H. Dahl, Lawton St.—Fifteen cows; in good condition; barn and ventilation fair; feed bran, shorts and cornfodder; spring water.

Fred Lindemann, Missouri St.—Seven cows; in good condition; stable and ventilation very poor; feed bran, shorts and wild hay; well water.

A. Gagnier, Florida St.—Thirty-four cows; in good condition; good barn; fair ventilation; feed bran, shorts and clover hay; well water.

E. Solman, Bangor St.—Five cows; in good condition; stable and ventilation good; feed bran, shorts, wild hay; well water.

Hammermeister Bros., Stickney St.—Forty cows; in good condition; stable and ventilation good; feed bran, shorts, vinegar waste and wild hay; spring water.

J. J. Murray, South Park—Sixteen cows; in good condition; stable and ventilation good; feed bran, shorts and wild hay; well water.

Albert Peffer, South Park—Nine cows; in good condition; stable and ventilation good; feed corn meal and wild hay; well water.

John Ausland, South St. Paul—Eight cows; in good condition; barn and ventilation good; feed bran, shorts and clover hay; spring water.

John Seigfried, South Park—Twenty cows; in good condition; stable and ventilation good; feed bran, shorts and tame hay; well water.

B. Bernhardt, St. Paul—Twenty cows; in good condition; stable and ventilation good; feed bran, shorts and tame hay; well water.

D. Blair, South Park—Fourteen cows; in good condition; stable and ventilation good; feed shorts and wild hay; well water.

Bear Bros., German Road—Thirty cows; in good condition; stable good; ventilation fair; feed shorts and ground feed; well water.

John P. Mattson, Minnehaha St.—Fourteen cows; in good condition; stable and ventilation good; feed malt, bran, shorts and wild hay; well water.

M. Clearey, Dodd Road—Twelve cows; in good condition; stable and ventilation good; feed bran, corn meal and timothy hay; well water.

J. Jonas, Ohio St.—Four cows; in fair condition; good stable; poor ventilation; feed bran, screenings and wild hay; well water.

John Anderson, Hudson Ave.—Twelve cows; in good condition; stable and ventilation good; feed bran, shorts, timothy hay; well water.

John Roths, 1166 Euclid Ave.—Eleven cows; in good condition; stable and ventilation good; feed ground feed and hay; well water.

L. Paulson, 1315 E. 3d St.—Nine cows; in good condition; stable and ventilation good; feed bran, shorts and clover hay; lake water.

K. Johnson, 1229 Grotto St.—Twelve cows; in good condition; stable good; ventilation poor; feed bran, shorts and clover hay; lake water.

F. & H. Meyers, Sigel St.—Eleven cows; in good condition; good stable; poor ventilation; feed malt, bran, and tame hay; lake water.

Hans Johnson, Sigel and Folsom Sts.—Twenty cows; in good condition; stable and ventilation good; feed malt, shorts, fodder and hay; lake water.

J. W. Nelson, Sigel St.—Eighteen cows; in good condition; stable good; ventilation poor; feed malt, bran and hay; well water.

C. Anderson, Sigel St.—Six cows; in good condition; stable good; poor ventilation; feed bran, cockle, clover and timothy; well water.

Peterson Bros., 1510 Maryland St.—Seventeen cows; in good condition; stable good; ventilation poor; feed bran, shorts, malt, clover hay; lake water; one cow sick, udder badly swollen.

Gus Stone, Bock and Maryland Sts.—Fourteen cows; in extra good condition; stable and ventilation good; feed bran, shorts, malt and timothy hay; lake water.

H. Morgan, Bock and Maryland Sts.—Twelve cows; in good condition; stable and ventilation extra good; feed bran, shorts, malt and wild hay; lake water.

Swan Matson, Beech St.—Eight cows; in good condition; stable and ventilation good; feed malt, shorts, bran and wild hay; lake water.

John Peterson, Beech St.—Eight cows; in good condition; stable good; ventilation poor; feed bran, shorts and wild hay; well and lake water.

Mathias Pierson, Beech St.—Five cows; in good condition; stable good; ventilation poor; feed bran, shorts and wild hay; well water.

H. W. Hanson, Reaney St.—Twenty-six cows; in good condition; stable and ventilation good; feed bran, shorts, clover hay; well water.

John Lundgaard—Nine cows; in good condition; stable and ventilation good; feed bran, shorts, malt and straw; well water.

Chas. Hanson—Eight cows; in good condition; stable good; ventilation poor; feed bran, shorts and wild hay; well water.

Jacob Haney, E. 7th St.—Nineteen cows; in good condition; stable and ventilation; feed shorts, clover and tame hay; well water.

Henry Huffmeier, Hazel Park—Thirty-one cows; in good condition; stable and ventilation good; feed shorts, bran and tame hay; well water.

P. Pierson, Gladstone—Fourteen cows; in good condition; barn and ventilation good; feed bran, malt and wild hay; lake water.

J. B. Little, Lake Phalen—Five cows; in good condition; stable good; ventilation poor; feed shorts and wild hay; lake water.

Sam Johnson, Cary St.—Forty-three cows; in good condition; stable and ventilation; feed bran, cockle, shorts, timothy hay; well water.

G. Damberg, Edgerton St.—Sixty-eight cows; in good condition; stable and ventilation good; feed bran, shorts and tame hay; well water.

C. Peterson, Cleveland Ave.—Thirty-two cows; in good condition; stable and ventilation good; feed bran, shorts and cornstalks; well water.

D. E. Swanson, Edgerton St.—Seventeen cows; in good condition; stable and ventilation good; feed malt, bran, shorts, clover hay; well water.

J. A. Johnson, Edgerton St.—Twenty-two cows; in fair condition; good stable and ventilation; feed bran, shorts and malt; clover hay; lake water.

Olaf Feltheim, Idaho and Bradley Sts.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts; malt and tame hay; lake water.

Fred Hersig, Bradley St.—Twenty cows; in good condition; good stables and ventilation; feed bran, shorts, malt and tame hay; lake water.

C. Jacobson, Bradley St.—Twelve cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; lake water.

T. Torgerson, Edgerton St.—Seventeen cows; in good condition; good stable and ventilation; feed bran, shorts, malt and tame hay; lake water.

A. J. Peterson, Edgerton St.—Seventeen cows; in good condition; good stable and ventilation; feed bran, shorts, ground feed, clover hay; lake water.

N. T. Peters, Edgerton St.—Four cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; lake water.

Fred Pinska, Edgerton St.—Forty-two cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; lake water.

E. Schlozer, Rice St.—Twenty-one cows; in good condition; good stable and ventilation; feed bran, shorts, corn meal, clover hay; well water.

D. Benecke, Rice St.—Eleven cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; spring water.

John Gobely, Nevada St.—Twenty cows; in good condition; extra good stable and ventilation; feed bran, shorts, ground feed and tame hay; well water.

Paul Spregel, Rice St.—Twenty-one cows; in good condition; good stable and ventilation; feed bran, shorts, corn meal, clover hay; well water.

Bearth Bros., Oliver and Kansas Sts.—Twenty-six cows; in good condition; good stable and ventilation; feed bran, shorts, clover hay; well water.

Lee Pinska, Edgerton St.—Twenty-nine cows; in good condition; good stable and ventilation; feed corn meal, bran, fodder and hay; well water.

M. J. Clouse, Jarvis Lake—Nineteen cows; in condition; good stable and ventilation; feed bran, malt, cockle, fodder and clover hay; well water.

Herman Freutel, Cottage St.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts, ground feed and clover hay; well water.

Henry Freutel, Phalen Ave.—Thirty-three cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

Ole Hamre, Phalen Ave.—Three cows; in good condition; good stable and ventilation; feed bran, corn meal and clover hay; well water.

J. Holanitsch, Phalen Ave.—Twelve cows; in good condition; good barn and ventilation; feed ground feed, shorts and clover hay; spring water.

A. Thomas—Twenty-five cows; in good condition; good barn and ventilation; feed bran, shorts, clover hay; well water.

John Baumann, Marion St.—Ten cows; in good condition; good stable; fair ventilation; feed bran, shorts, malt, clover hay; well water.

H. Leuer, Albemarle St.—Fifteen cows; in good condition; good stable; fair ventilation; feed bran, shorts, cockle, clover hay; well water.

Frank Unfried, New Canada—Ten cows; in good condition; good stable and ventilation; feed shorts, cornstalks and clover hay; well water.

Matt Strautz, Little Canada—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

B. Meadow, Little Canada—Ten cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

Gulipson Bros., Maryland St.—Thirty-six cows; in good condition; good stable and ventilation; feed bran, shorts, malt and clover hay; well water.

Schmidt Bros., Farrington Ave.—Fifteen cows; in good condition; good stable; poor ventilation; feed ground feed and tame hay; well water.

A. Mendt, Farrington—Fifteen cows; in good condition; good barn and ventilation; feed shorts, malt, corn meal and tame hay; well water.

Mollet Alcide, Farrington Ave.—Eleven cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

Geo. Meadow, Little Canada—Ten cows; in good condition; good barn and ventilation; feed bran, shorts, tame hay; well water.

Bragg Bros., Snelling Ave.—Seventy-seven cows; in good condition; good stable and ventilation; feed corn meal and clover hay; well water.

J. W. Smith, W. 7th St.—Thirty-four cows; in good condition; good stable and ventilation; feed bran, shorts, malt, corn meal and clover hay; well water.

G. Luther, W. 7th St.—Twenty-nine cows; in fair condition; barn and ventilation good; feed bran, shorts, malt, wild and clover hay; spring water.

H. McCue, W. 7th St.—Twenty-two cows; in good condition; good stable; poor ventilation; feed bran, vinegar waste, wild hay; spring water.

S. Stutzennegger, Stewart Ave.—Seventeen cows; in good condition; good barn and ventilation; feed malt, shorts, clover and wild hay; well water.

J. Hinkel, Fort Snelling—Fourteen cows; in good condition; poor stable and ventilation; feed malt, bran, shorts and clover hay; well water.

F. Moser, W. 7th St.—Ten cows; in good condition; good stable and ventilation; feed cornmeal, shorts and clover hay; well water.

C. Sathir, Adrian St.—Twenty-nine cows; in good condition; good stable; poor ventilation; feed malt, shorts, millet and wild hay; well water.

C. F. McCarron, McCarron's Lake—Thirty cows; in good condition; good stable and ventilation; feed cornmeal, bran, flour and tame hay; well water.

A. Zibell, McCarron's Lake—Twelve cows; in good condition; good stable and ventilation; feed bran, cornmeal and clover hay; well water.

E. Knowlan, McCarron's Lake—Thirty-eight cows; in good condition; good stable and ventilation; feed cornmeal, timothy and wild hay; well water.

Wm. Schuette, Mississippi St.—Twelve cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

H. Montgomery, Arkwright St.—One hundred and eleven cows; in good condition; good stable and ventilation; feed corn, bran, flour, tame hay; well water.

John Olson, De Soto St.—Forty-one cows; in good condition; good stables and ventilation; feed bran, shorts and tame hay; well water.

B. M. Pierce, De Soto St.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts, tame hay; well water.

Victor Breslauer, South St. Paul—Three cows; in good condition; good stable; poor ventilation; feed ground feed, bran and wild hay; well water.

M. Mollers, South St. Paul—Eight cows; in poor condition; good barn and ventilation; feed bran, shorts and timothy hay; well water.

H. G. Marthaler, West St. Paul—Nine cows; in good condition; good barn; poor ventilation; feed corn, bran and timothy hay; well water.

B. Lautenbach, West St. Paul—Four cows; in good condition; good barn; poor ventilation; feed corn, bran and timothy hay; well water.

M. Schneider, Rice St.—Ten cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

Fred Mund, Rice St.—Twenty-two cows; in good condition; stable and ventilation good; feed bran, shorts and tame hay; well water.

Henry Schneider, Rice St.—Seventy-four cows; in good condition; good stable and ventilation; feed bran, cornmeal and tame hay; well water.

J. Hurley, West St. Paul—Twenty-three cows; in good condition; good stable and ventilation; feed malt, bran, shorts and tame hay; well water.

D. F. Wright, West St. Paul—Nineteen cows; in poor condition; barn and ventilation poor; feed malt, shorts and wild hay; well water.

G. W. Wentworth, West St. Paul—Thirty cows; in good condition; good stable and ventilation; feed cornmeal, shorts and bran, tame hay; well water.

Mrs. F. Errick, South St. Paul—Twenty cows; in fair condition; stable good; ventilation poor; feed shorts, bran, wild hay; well water; one sick cow; ordered to be disposed of.

Lena Schapery, South St. Paul—Seven cows; in fair condition; poor stable and ventilation; feed cornmeal, shorts and wild hay; well water.

F.C. Hammond, West St. Paul—Nine cows; in good condition; stable and ventilation good; feed cornmeal, shorts, tame hay; well water.

O. McMahon, Phalen Ave.—Fifteen cows; in good condition; stable and ventilation good; feed bran, shorts and clover hay; well water.

Jno. Linberg, Phalen Ave.—Thirty cows; in good condition; stable good; ventilation poor; feed bran, shorts and clover hay; well water.

N. J. Ahlston, Phalen Ave.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; lake water.

M. Remakel, Como and Phalen Ave.—Eleven cows; in good condition; good stable and ventilation; feed malt, shorts and clover hay; lake water.

A. Anderson, 940 Payne Ave.—Twenty cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; well water.

Geo. Beatson, Rose St.—Twenty-six cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; well water.

C. Gustafson, Rose St.—Ten cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; well water.

Frank Johnson, Rose St.—Eight cows; in good condition; good stable; poor ventilation; feed bran, shorts and clover hay; well water.

J. P. Rudeen, 727 Magnolia St.—Six cows; in good condition; good stable; poor ventilation; feed bran, malt and wild hay; well water.

T. Christianson, Weide and Jessamine Sts.—Eight cows; in good condition; dirty stable; poor ventilation; feed bran, meal, tame hay; well water.

L. Ebert, Geranium St.—Four cows; in poor condition; good stable; poor ventilation; feed bran and tame hay; well water.

Mrs. Whitestone, 864 Geranium St.—Two cows; in good condition; good stable; poor ventilation; feed bran, shorts, tame hay; well water.

B. Dixson, Gladstone—Twenty cows; in good condition; good stable; poor ventilation; feed bran, malt and timothy hay; lake water.

E. J. Johnson, Minnesota Transfer—Thirty-two cows; in fair condition; bad stable and ventilation; feed ground cockle and tame hay; well water.

Glennen & McGrew, St. Anthony Ave.—Twenty-five cows; in fair condition; poor stable and ventilation; feed ground cockle and wild hay; well water.

J. N. Booth, Merriam Park—Thirteen cows; in good condition; good stable and ventilation; feed cornmeal, bran, tame hay; spring water.

Mike Affenbacher, Dodd Road—Three cows; in good condition; good stable; bad ventilation; feed bran and tame hay.

C. Hupp, Lillydale—Eight cows; in good condition; good stable; bad ventilation; feed oil meal, bran, vinegar waste, tame hay; well water.

C. J. Clark, Lillydale—Seventeen cows; in good condition; good stable; bad ventilation; feed cornmeal, bran and clover hay; well water.

Peter Bendixen, Lillydale—Eighteen cows; in good condition; good stable and ventilation; feed cornmeal, bran and wild hay; well water; one cow sick.

D. Griffin, Mendota Road—Thirteen cows; in fair condition; barn and ventilation fair; feed cornmeal and wild hay; spring water.

Nick Welsh, Mendota Road—Sixteen cows; in good condition; stable and ventilation good; feed malt, bran, shorts and tame hay; well water.

L. Webber, Mendota Road—Fifteen cows; in good condition; barn and ventilation poor; feed bran, shorts and tame hay; well water.

Frank Gessner, Mendota Road—Nine cows; in poor condition; stable and ventilation poor; feed malt and tame hay; spring water.

A. C. Staples, Dodd Road—Fourteen cows; in good condition; stable and ventilation good; feed bran, cornfodder and hay; well water.

H. Schumann, Delaware Ave.—Nine cows; in good condition; stable and ventilation good; feed bran and tame hay; well water.

James McGuire, Delaware Ave.—Fourteen cows; in good condition; stable and ventilation good; feed bran, oil meal, fodder, tame hay; well water.

Geo. Staples, Dodd Road—Twenty cows; in good condition; stable and ventilation good; feed bran, cornmeal, fodder and tame hay; well water.

Henry Peiper, Hartshorn St.—Eleven cows; in good condition; good stable; bad ventilation; feed malt, bran, potatoes, tame hay; well water.

R. Bryant, Arcade St.—Fifty-one cows; in good condition; good stable and ventilation; feed bran, corn, oats, clover hay; well water.

G. Peterson, Hyson St.—Eight cows; in good condition; good stable; poor ventilation; feed malt, bran, shorts, wild hay; well water.

G. F. Jackson, Hyson St.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts, malt, tame hay; well water.

L. E. Irmscher, Carter St.—Six cows; in good condition; good stable; poor ventilation; feed cornmeal, shorts, tame hay; spring water.

Hans Clausen—Twenty-one cows; in good condition; stable fair; ventilation poor; feed ground cockle, cornfodder and wild hay; well water.

O. C. Miller, Burr Ave.—Nine cows; in good condition; stable and ventilation good; feed bran, shorts, clover hay; spring water.

A. Larson, Burns Ave.—Fifteen cows; in good condition; good stable and ventilation; feed cornmeal, bran, tame hay; spring water.

F. Tschida, Ray St.—Sixteen cows; in good condition; good stable and ventilation poor; feed bran, shorts, tame hay; well water.

C. Spangenberg, Rice St.—Fifteen cows; in good condition; good stable and ventilation; feed malt, bran, shorts and clover hay; well water.

M. Strandberg, New Canada—Twelve cows; in good condition; good stable and ventilation; feed bran, shorts and wild hay; well water.

E. Richter, New Canada—Fifteen cows; good condition; good stable and ventilation; feed malt, shorts, fodder and clover hay; well water; hogs kept in cows' barn.

L. W. Baumgartner, Rice St.—Sixteen cows; in good condition; good stable; poor ventilation; feed bran, shorts and tame hay; well water.

C. Seiberlich, Rice St.—Thirty cows; in good condition; good stable and ventilation; feed bran, shorts, tame hay; well water.

F. Seiberlich, Rice St.—Fourteen cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

Wm. Dohmer, Rice St.—Twenty-two cows; in good condition; good barn and poor ventilation; feed bran, shorts and tame hay; well water.

D. Kuhn, W. Maryland St.—Four cows; in good condition; good stable and ventilation; feed bran, shorts and tame hay; well water.

A. J. Vogel, Ellis St.—Thirteen cows; in good condition; good barn; poor ventilation; feed bran, shorts and tame hay.

E. Dilger, Mackubin and Carbon Sts.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; well water.

Fred Obi, 597 Farrington Ave.—Ten cows; in good condition; good stable and ventilation; feed malt, shorts and clover hay; well water.

Gus Bothke, South and St. Albans Sts.—Fifteen cows; in good condition; good stable and ventilation; feed bran, shorts and clover hay; well water.

John Bergmann, South and St. Albans—Twenty cows; in good condition; good stable; poor ventilation; feed bran, shorts and clover hay; well water.

J. W. Jackson, Phalen Ave.—Forty-six cows; in good condition; good stable and ventilation; feed cornmeal, shorts and clover hay; well water.

Schonno & Sturg, Lake Como—Thirty-four cows; in good condition; good stable and ventilation; feed shorts, cornmeal and tame hay; well water.

E. M. Johnston, Lexington Ave.—Forty cows; in good condition; good stable and ventilation; feed bran, shorts and wild and tame hay; well water.

F. R. Peck, Edmund St.—Sixty-eight cows; in good condition; good stable and ventilation; feed cornmeal, bran and tame hay; well water.

John A. Johnson, Lincoln St.—Twelve cows; in good condition; good stable and ventilation; feed bran, shorts, tame and wild hay; well water.

John Johnson, Grant Ave.—Twenty-three cows; in good condition; good stable and ventilation; feed bran, shorts, cornmeal, clover hay; well water.

Bayliss & Son, Fairmont Ave.—Twenty-nine cows; in fair condition; fair stable and ventilation; feed bran, shorts, clover hay; well water.

M. Mossong, Hester St.—Twenty-five cows; in fair condition; fair stable; poor ventilation; feed bran, shorts and wild hay; spring water.

Mary Anderson, Oakland St.—Thirty-five cows; in good condition; good stable and ventilation; feed bran, shorts, malt and wild hay; spring water.

W. S. Ellis, Stewart Ave.—Fourteen cows; in good condition; poor stable and ventilation; feed bran, shorts and tame hay; well water.

Frank Hall, Stewart Ave.—Ten cows; in good condition; bad stable and ventilation; feed bran, shorts and tame hay; well water.

Geo. Porelies, Stewart Ave.—Six cows; in fair condition; poor stable and ventilation; feed malt, ground feed and clover hay; well water.

John Zinell, Butternut Ave.—Five cows; in good condition; poor stable and ventilation; feed, vinegar waste, clover hay; well water.

Louis Stipen, Stewart Ave.—Two cows; in good condition; fair barn; poor ventilation; feed shorts and wild hay; well water.

M. Booth, Ridgewood Park—Eight cows: in good condition; good barn; poor ventilation; feed shorts and wild hay; well water.

P. J. Keough, Hamline Ave.—Thirty-two cows; in good condition; stable and ventilation good; feed malt, bran, cornmeal and wild hay; well water.

G. Smith, Ottawa Ave.—Twenty cows; in good condition; good stable and ventilation; feed malt, shorts and wild hay; well water.

W. Rixmun, Hartford Ave.—Eight cows; in fair condition; stable fair; ventilation poor; feed bran, shorts and tame hay; well water.

Michael Dunn, Ottawa Ave.—Twenty cows; in good condition; fair barn; poor stable; feed shorts and tame hay; spring water.

Peterson Bros., Cleveland Ave.—Fifty-five cows; in good condition; good stable and ventilation; feed shorts, ground cockle, tame hay; well water.

P. J. Luby, Montreal St.—Seventeen cows; in good condition; good stable; poor ventilation; feed shorts, wild and tame hay; well water.

Mooney Bros., Snelling Ave.—Twenty-nine cows; in good condition; stable and ventilation good; feed cornmeal and tame hay; well water.

Stable inspection at Duluth by Assistant Commissioner E. J. Graham May, 1893.

Fred Sick, Oakland Addition—Fifteen cows; condition extra good; stable clean; well ventilated; feeds bran, oil meal, wild hay; spring water.

J. N. Lundquist, Central Ave.—Eleven cows; condition good; stable fair; poor ventilation; feeds bran and wild hay; spring water.

C. R. Johnson, Central Ave.—Thirteen cows; extra good condition; stable fair; ventilation fair; feeds bran, shorts and wild hay; use well and creek water.

G. W. Bergtold, Hulett Farm—Twenty-four cows; extra good condition; stable good; ventilation fair; feeds bran, shorts, oil cake, wild and timothy hay.

P. Grant, Culiford Farm—Thirteen cows; in good condition; good stable; ventilation good; feeds bran, shorts and wild hay; well water.

A. Pederson, 1011 W. 5th St.—Twenty-eight cows; in good condition; good stable and well ventilated; feeds shorts, bran and wild hay; well water.

W. H. McDonald, 1302 W. 5th St.—Thirteen cows; in good condition; stable and ventilation good; feeds bran, shorts, corn and wild hay; spring water.

G. Johnson, 1106 W. 5th St.—Twenty-six cows; in good condition; good stable; no ventilation; feeds wild hay, bran and shorts; spring water.

A. Johnson, near W. 6th St.—Four cows; in good condition; good stable; no ventilation; feeds bran, shorts and wild hay; spring water.

John Proff, 910 W. 5th St.—Ten cows; in extra good condition; stable and ventilation good; feeds bran, shorts, oil cake and wild hay; creek water.

J. Epple, 910 W. 5th St.—Ten cows; in extra good condition; stable and ventilation good; feeds flour, oil cake and wild hay; creek water.

W. B. Blake, 707 W. 5th St.—Seven cows; in fine condition; good stable with fair ventilation; feeds bran, shorts and wild hay; creek water.

REPORT OF FIRST ASSISTANT DAIRY AND FOOD COMMISSIONER.

To Hon. Berndt Anderson, Dairy and Food Commissioner,

Sir: My appointment as first assistant dairy and food commissioner took effect January 27, 1893, and, being assigned the supervision of the dairy department of this commission, I beg leave to make the following report:

The laws under which we operate contemplate that this department shall superintend the production, transportation, manufacture and sale of all products of the dairy, and that we may visit all places of production, transportation, manufacture, or sale, and may make inspection of all such products for the purpose of ascertaining if they are clean, healthful, unadulterated and wholesome.

They also allow the giving of instructions in butter and cheese making, which would justify one in giving advice as to the best methods, best machinery, or any other advice calculated to advance the dairy interests of any locality or the state at large.

With these facts in view I have endeavored to make as complete an inspection as possible with the limited time and a limited expense, and have used my best efforts to advance the dairy interests of our state in all branches. During the year and a half which I have held this position I have succeeded in visiting nearly every creamery in Minnesota, numbering upwards of 300, and, as most of my work has been with the creameries, it is proper that I should give an outline of work done with them, and a general report of them, noting all items of interest, offering suggestions for their benefit, and furnishing a reference list of value to them, and other interests depending on them.

In visiting these creameries I have had in view a number of objects which might here be enumerated as follows, viz.:

First. To locate the factory, ascertain plan of conducting, process and kind of machinery used, amount and quality of butter produced, the address of managers and makers, number of patrons, and conditions of the dairy interests of such places.

Second. To ascertain the sanitary condition of the factory, and that the patrons delivered clean, wholesome milk in clean cans, and that it was unadulterated.

Third. To give such advice and assistance as I found them in need of, relative to the proportionate payment of the patrons and the manufacture of the best products, to the end that the factory produce the most wholesome product possible, and with profit to the producer, so that he can afford to, and will produce and deliver a clean, healthful, wholesome product for the factory.

Fourth. To ascertain if there was any excessive losses in the process of manufacture, call attention to them and assist in remedying them.

As to the first of these objects I submit the following table, showing a list of creameries in Minnesota operated in 1894, their location, process and separators used, organization, manager's address, number months operated, capacity and names of creameries.

CREAMERIES.

COUNTY AND POSTOFFICE.	Number Patrons.	Process.	Organization.	Proprietor or Manager.	Months Operated.	Remarks.
Anoka ....Anoka	150	Gather cream....	Stock Co........	T. F. Pratt	12	
Becker......Lake Park	170	Gather cream....	Pv.	Wagnestad & Wangenst'n.	12	
Becker......Lake Park	172	Gather cream....	Private.........	J. Danielson	12	
Becker ....Audubon	...	Gather cream....	Private	....	..	
Blue Earth, Madison Lk	...	1 Jumbo.........	Stock Co......	I. B. Reynolds	1	New
Blue Earth....St. Clair	204	Gather cream....	Private.	Grigen & Coughnour	12	
Blue Earth, Gard'n City	...	1 Acme..........	Private....	W. D. Richardson	12	New
Blue Earth, G'd Thund'r	40	2 Sharples Belt..	Private......	Sohn & Handel	8	
Blue Earth....Butternut	78	2 Alpha No. 1...	Co-operative....	G. Gutterson	8	New
Benton ....Foley	70	Gather cream....	Corporation....	E. G. Potter	6	
Brown ....Madelia	97	1 Jumbo, 1 Reid.	Co-operative.......	John Moe	12	
Brown ....St. James	107	2 Danish Weston	Co-operative.......	E. Nelson	12	
Brown ....New Ulm	325	Gather cream....	Private............	H. Crone	10	
Brown......Sleepy Eye	40	1 No. 1 Alpha...	Co-operative...	G. J. Vollmer	7	Stark Cr.
Brown......Sleepy Eye	40	1 Sharples.......	Co-operative.....	F. Cromlett	8	Albion
Brown ....Madelia	40	1 Sharples.......	Co-operative....	C. Halverson	8	
Brown........New Ulm	41	1 De Lavel......	Co-operative...	H. Hillesheim	8	
Carver..Young America	80	1 De Lavel......	Corporation.....	E. G. Potter	6	
Chisago......Rush City	82	Gather cream....	Private............	R. Rogers	12	
Clay ....Hitterdal	80	Gather cream....	Private....	M. R. J. Herrick	3	
Clay ....Hawley	106	Gather cream....	Private......	Johnson & Berg	12	
Clay ....Moorhead	50	Gather cream....	Private.......	O. S. Hadland	8	
Clay ....Ulen	97	Gather cream....	Private.......	Evanson Bros	3	
Clay ....Muskado	100	Gather cream....	Private........	Evanson Bros	3	
Cottonwood ....Storden	70	2 No. 1 Alpha...	Co-operative....	J. P. Nelson	8	
Dodge....Dodge Centre	225	2 Sharples Stand.	Private..........	A. Webster	12	
Dodge ....Oslo	420	Gather cream....	Co-operative.......	B. O. Roe	12	
Dodge ......Mantorville	141	Gather cream....	Co-opera...	F. W. Van Ornum	10	Rebuilt.
Dodge ....Wasioja	300	1 De Lavel......	Co-operative..	G. W. Bartlett	10	Reorganiz'd
Dodge ....Hayfield	40	1 No. 1 Alpha...	Co-operative....	O. O. Distad	10	New.
Douglas ....Brandon	63	Gather cream....	Private..........	B. T. Teigen	6	
Douglas .....Evansville	80	1 De Lavel......	Private.....	H. C. Halverson	7	
Douglas ....Osakis	100	Gather cream....	Co-operative...	F. A. Ranney	12	
Douglas ....Nelson	60	2 No. 1 Alpha....	Co-operative....	C. H. Jensen	6	New.
Faribault....Blue Earth	235	1 No. 1 Alpha...	Private........	Levenick Bros	7	
Faribault ......Clayton	40	1 No. 1 Alpha...	Co-operative....	J. R. Moody	8	New.
Faribault ....Easton	150	Gather cream....	Co-operative,	Zienner & Roch	7	
Faribault ....Banks	70	2 No. 1 Alphas..	Co-operative....	R. F. Drake	8	New.
Faribault ......Clayton	70	2 No. 1 Alphas..	Co-operative.....	Ole Haugen	8	New.
Faribault ....Wells	52	2 No. 1 Alphas..	Co-operative........	B. Berri	7	
Faribault ....Wells	80	2 No. 1 Alphas..	Co-operative	....	7	New.
Faribault ......Delevan	125	1 De Lavel......	Private......	Holter & Thies	7	Burned.
Faribault...Minn. Lake	120	1 Sharples Stand.	Co-operative.......	O. Mullin	7	
Faribault ....Keister	75	2 No. 1 Alphas..	Co-operative ,	T. D. Robertson	8	New.
Fillmore ......Fountain	37[illegible]	Gather cream....	Co-operative....	W. A. Balles	12	
Fillmore. Spring Valley	600	Gather cream....	Co-operative....	Geo. Farmer	12	
Fillmore .....Harmony	200	Gather cream....	Co-operative...	D. A. Mosher	12	
Fillmore ......Rushford	440	Gather cream....	Co-operative.....	L. Knudson	12	
Fillmore ....Whalen	225	Gather cream....	Corporation..	W. Beard & Son	6	
Fillmore .....Lanesboro	100	Gather cream....	Corporation...	G. L. Hubbell	6	
Fillmore ....Canton	110	Gather cream....	Corporation...	G. L. Hubbell	6	
Fillmore ......Preston	140	2 Sharples Stand.	Private.....	Graham & Olson	12	
Fillmore ....Mabel	250	1 Sharples Stand.	Private....	Bersie & Bersie	12	
Fillmore ....Racine	60	1 No. 1 Alpha....	Co-operative...	W. A. Wilson	9	
Freeborn ....Geneva	75	2 No. 1 Alphas..	Co-operative...	P. J. Lawson	8	New.
Freeborn ....Newry	75	2 No. 1 Alphas..	Co-operative....	T. F. Herron	2	New.
Freeborn....Albert Lea	100	2 No. 1 Alphas..	Co-operative...	M. Halverson	12	
Freeborn....Albert Lea	102	1 No. 1 Alpha... 2 De Lavel......	Co-operative......	O. Sanberg	12	
Freeborn....Albert Lea	100	3 No. 1 Alphas..	Co-operative,	P. H. Overgaard	12	
Freeborn ....Bath	51	2 No. 1 Alphas..	Co-operative......	J. St. John	12	
Freeborn ....Alden	81	2 No. 2 Alphas..	Co-operative.....	A. Robinson	12	
Freeborn ....Armstrong	9	2 No. 1 Alphas..	Co-operative.....	C. H. Ruble	12	
Freeborn..Clark's Grove	115	1 De Lavel...... 3 No. 1 Alphas..	Co-operative......	C. H. Dills	12	
Freeborn .....Freeborn	70	1 No. 1 Alpha...	Co-operative....	G. M. Miller	12	
	70	1 No. 2 Alpha...				
Freeborn ....Geneva	70	2 No. 1 Alphas..	Co-operative.....	M. J. Quinn	12	
Freeborn .....Hartland	64	1 No. 2 Alpha... 1 Alexandria....	Co-operative...	J. C. Sibilrud	12	
Freeborn ......Glenville	151	4 Sharples Stand.	Co-operative...	A. W. Trow	12	

CREAMERIES—*Continued.*

COUNTY AND POST OFFICE.	Number Patrons.	Process.	Organization.	Proprietor or Manager.	Months Operated.	Remarks,
Freeborn .....Hayward	80	2 No. 1 Alphas..	Co-operative...	H. G. Nelson	12	
Freeborn ...Manchester	80	1 No. 1 Alpha... 1 Alexandria....	Co-operative.....	B. D. White	12	
Freeborn .....Mansfield	64	2 Danish West'ns	Co-operative...	J. H. Seedorf	12	
Freeborn ....Moscow	45	1 No. 1 Alpha...	Co-operative.......	C. Rettig	12	
Freeborn ......Oakland	39	1 No. 1 Alpha...	Co-operative....	J. T. Purcill	7	
Freeborn..Deer C'k, Ia.	80	1 Alpha, 1 Acme.	Co-operative.....	M. J. Rohn	12	
Freeborn .....Hayward	35	2 No. 1 Alphas..	Co-operative.......	O. A. Roe	12	
Freeborn...Twin Lakes	82	2 Danish West'ns	Co-operative......	J. Widman	12	
Freeborn...Twin Lakes	70	2 No. 1 Alphas..	Co-operative..	W. Wadsworth	12	
Freeborn ......Emmons	100	3 No. 1 Alphas..	Co-operative..	G. H. Emmons	12	2 Stations.
Freeborn ....London	40	1 No. 1 Alpha...	Dividend........	D. M. Jones	7	New.
Goodhue, Belvid're Mills	65	1 Sharples Stand.	Co-operative..	G. O. Gaylord	8	Burned.
Goodhue..Cannon Falls	110	2 Danish West'ns	Corporation........	Crescent	12	1 Station.
Goodhue...Forest Mills	180	1 Sharples Stand.	Private..	W. B. Dickey & Co	12	2 Stations.
Goodhue ......Goodhue	160	1 De L,. 1 Rus'n.	Co-operative......	J. McHugh	12	1 Station.
Goodhue ....Kenyon	300	5 Sh'rples Stand. 3 No. 1 Alpha 1 D'nish, 1 Ex'tr	Dividend.........	Lubke Bros	12	
Goodhue ....Kenyon	400	Gather cream... 2 No. 1 Alphas..	Corporation........	Crescent	12	7 Stations.
Goodhue ....Kenyon	300	1 Alexandria....	Co-operative....	O. Bruslater	12	1 Station.
Goodhue....White Rock	210	1 Stand Russian.	Private..........	G. O. Miller	12	1 Station.
Goodhue ...Wanamingo	100	Gather cream...	Stock Co...........	O. Gorlid	12	
Goodhue ...Wanamingo	150	Gather cream...	Co-operative		12	Reorganiz'd
Goodhue .....Zumbrota	250	2 D'nish W'stons 2 Sharples Stand	Corporation	Crescent	12	3 Stations.
Goodhue .....Frontenac	25	1 Jumbo.......	Co-operative.......	J. I. Goff	12	
Grant ....Ashby	30	1 Jumbo........	Co-operative.....	J. M. Steni	5	
Grant......Elbow Lake	25	1 Jumbo........	Co-operative..	H. P. Hanson	4	New.
Hennepin ..Minneapolis	70	Gather cream...	Private.......	J. S. Swenson	12	
Hennepin ..Minneapolis	100	Gather cream...	Private...	Minnesota Milk Co	12	
Hennepin...Maple Plain	40	1 Stand. Russian	Co-operative.....	F. S. Coffin	2	New.
Houston ......Freeburg	200	Gather cream...	Co-operative......	G. Brenner	12	
Houston ....Houston	325	Gather cream...	Co-operative....	J. P. Onstad	12	
Houston...Spring Grove	225	Gather cream...	Private..........	O. Kjomme	12	
Houston ...Wilmington	300	Gather cream...	Private.....	J. E. Eiden & Co	12	
Houston ....Bee	150	Gather cream...	Co-operative.....	A. P. Dille	..	
Kandiyohi .....Atwater	68	1 D'nish 24 in...	Co-operative..	D. F. Seneshal	8	
Kandiyohi .....Atwater	15	1 Acme.........	Private........	Anna Pearson	6	New.
Kandiyohi..New London	50	Gather cream...	Co-operative....	G. M. Dodd	4	
Kandiyohi, L'ke Eliz'b'h	50	1 D'nish 24 in..	Co-operative..	P. E. Edmund	8	
Kandiyohi..Lake Lilian	301	De Lev. 1 Acme.	Private,	B. E. Anderson & Co	8	
Kandiyohi .....Willmar	100	Gather cream...	Private......	Bakke & Giere	8	
Le Sueur...New Prague	300	Gather cream...	Private...........	C. Mickus	12	
Le Sueur......Le Sueur	450	Gather cream...	Private.........	Patten & Co	12	
Le Sueur.....Kilkenney	35	1 No. 1 Alpha..	Co-operative.....	C. D. Cotey	3	New.
Lyons ....Balatan	40	Gather cream...	Private........	Whiting Bros	6	
Lyons ....Tracy	90	1 De Lavel......	Stock Co........	M. L. Meyers	8	
Lyons ....Marshall	200	Gather cream...	Co-operative....	C. H. White	6	
Lincoln ....Tyler	60	2 D'nish W'stns.	Co-operative,	M. Sandergaard	7	
McLeod.... .....Acoma	30	Gather cream...	Co-operative...	G. W. Decker	12	Comb'n.
McLeod ....Biscay	50	1 No. 1 Alpha...	Co-operative.....	Carl Hagen	12	Comb'n.
McLeod ....Hutchinson	50	Separator	Co-operative..	P. W. Simpson	12	New com'n.
McLeod ....Sumpter	30	Set Milk........	Co-operative..	C. E. Barnum	12	Comb'n.
McLeod ....Stewart	150	Gather cream...	Private..........	Rehse Bros	2	
Martin ....Fairmont	25	1 Stand. Russian	Co-operative,	W. Stuckmeyer	12	
Martin ....Fairmont	200	Gather cream...	Private.........	Sinclair Bros	4	
Martin ......Sherburne	50	1 No. 1 Alpha...	Co-operative....	A. T. Hiedel	7	New.
Martin ....Granada	75	2 No. 1 Alphas..	Co-operative....	G. W. Miller	7	New.
Meeker......Grove City	50	2 D'nish W'stons	Co-operative....	C. C. Reigan	12	
Meeker ......Rosendale	90	2 D'nish 24 in...	Co-operative...	P. Martenson	12	
Meeker.....Cedar Mills	40	Gather cream...	Co-operative.....	Geo. Welch	12	Comb'n.
Meeker ....Litchfield	64	1 Alpha, 1 Rus'n.	Co-operative........	H. Ames	12	New.
Meeker ......Manannah	31	1 Imp. Russian..	Co-operative....	J. W. Torrey	5	New.
Meeker ....Greenleaf	65	2 Imp. Russians.	Co-operative.....	E. Evenson	12	New.
Mille Lacs....Princeton	209	Gather cream...	Stock Co.....	S. S. Petterson	12	
Morrison ......Royalton	60	Gather cream...	Private........	Russell & Co	12	
Morrison...Rich Prairie	10	1 Jumbo........	Co-operative.....	P. H. Berg	1	New.
Murray ....Chandler	40	1 Delavel Baby..	Co-operative......	O. E. Buss	4	
Mower ....Adams	330	1 No. 1 Alpha...	Private........	Mr. Westlake	12	
Mower .....Brownsdale	28	1 Jumbo........	Co-operative.....	Chas. Gage	12	

CREAMERIES.—*Continued.*

COUNTY AND POSTOFFICE.	Number Patrons.	Process.	Organization.	Proprietor or Manager.	Months Operated.	Remarks.
Mower ....Dexter	100	2 Russ'ns, 2 Imp.	Co-operative	E. S. Hoppin	12	3 Stations.
Mower ....Waltham	260	Gather cream...	Co-operative	F. L. Hill	12	
Mower..Grand Meadow	400	Gather cream...	Co-operative	R. E. Crane	12	
Mower......Rose Creek	169	Gather cream...	Private	Krebsbach Bros	12	
Mower...Red Oak Grove	66	2 D'nish W'stons	Co-operative	H. Thompson	12	
Mower ....Leroy	77	1 Alpha, 1 Rus'n.	Co-operative	G. W. Hardin	12	
Mower ....Lyle	250	Gather cream...	Private	Thompson & Dock	12	
Mower ....Austin	46	1 No. 1 Alpha...	Co-operative	C. D. Balden	12	New.
Mower ....Lansing	60	1 No. 1 Alpha...	Co-operative	H. M. McIntyre	9	New.
Mower......Rose Creek	69	2 No. 1. Alphas..	Co-operative	Ole Aslakson	8	New.
Mower ....Taopi	150	Gather cream...	Private	A. C. Johnson	5	
Nicollet ......Courtland	20	1 Jumbo........	Co-operative	J. R. Bowen	1	New.
Nicollet ....Traverse	250	Gather cream...	Co-operative	S. H. Briggs	12	
Nobles ....Worthington	100	Gather cream...	Private	H. H. Smith	4	
Norman ....Rindal	200	Gather cream...	Co-operative	G. Kallander	4	
Olmsted ......Chatfield	400	Gather cream...	Co-operative	T. Henry	12	
Olmsted .....Forestdale	30	2 De Lavel......	Private	H. D. Morse	12	
Olmsted ....Orinoco	100	2 De Lav., 1 D'sh	Private	McCray Bros	12	2 Stations.
Olmsted ....Laird	200	Gather cream...	Private	E. S. Hurning	12	
Olmsted, Pleas'nt Grove	100	1 De Lavel......	Co-operative	R. H. Russell	12	1 Station.
Olmsted .....Rochester	45	3 De Lavel......	Co-operative	O. R. Pease	12	Reorganiz'd
Olmsted .....Rochester	200	4 De Lavel......	Corporation	Crescent	12	2 Stations.
Olmsted ....Salem	40	2 St. Sh'pls 1 Al.	Corporation	Crescent	12	
Olmsted ....Viola	200	Gather cream...	Private	H. D. Morse	12	
Olmsted ....Byron	110	7 No. 1 Alphas..	Co-operative	J. R. Webb	12	2 Stations.
Olmsted......Rock Dell	355	Gather cream...	Co-operative	H. Olson	12	
Olmsted ....Orinoco	40	1 No. 1 Alpha...	Private	H. Hendrickson	6	New.
Otter Tail.......Dalton	53	Gather cream...	Co-operative	O. Nelson	3	
Otter Tail.........Stod	100	Gather cream...	Co-operative	T. L. Ohe	3	
Polk ....McIntosh	200	Gather cream...	Private	K. H. Brokke	2	
Pope ....Cyrus	150	Gather cream...	Co-operative	H. P. Hanson	4	
Pope ....Farwell	30	1 D'nish W'ston.	Co-operative	N. A. Fosberg	7	
Pope ....Lowry	65	Gather cream...	Co-operative	E. O. Holen	10	
Pope ....Starbuck	60	1 No. 1 Alpha...	Co-operative	O. J. Johnson	5	New.
Ramsey........St. Paul	250	4 Alphas, No. 1.. 1 Sh'pls, 1 D'ish.	Corporation	Crescent	12	4 Stations.
Ramsey........St. Paul	125	2 Acme, 2 Alphas	Private	Milton Dairy	12	2 Stations.
Ramsey........St. Paul	35	1 D'nish W'ston.	Private	Peoples' Dairy	12	1 Station.
Redwood..Redw'd Falls	18	1 De Lavel......	Private	C. E. Cain	4	
Redwood ....Lamberton	100	Gather cream...	Private	Hanson & Nelson	5	
Renville.....Bird Island	60	1 S'pls, 1 De Lav	Private	J. Richardson & Co	12	1 Station.
Renville ....Hector	40	1 Jumbo........	Co-operative	W. B. Strom	4	
Renville ....Olivia	125	Gather cream...	Private	J. B. Foreman	12	
Renville ....Franklin	35	1 No. 1 Alpha...	Co-operative	C. W. Parsens	3	New.
Rice ....Dundas	75	2 Alpha, 2 Sh'pls	Corporation	Crescent	12	2 Stations.
Rice ....Faribault	80	1 Alpha, 1 Imp..	Co-operative	F. A. Berry	5	1 Station.
Rice ....Northfield	160	4 Alphas, 2 S'pls.	Corporation	Crescent	12	3 Stations.
Rice ....Wolcott	168	2 Alphas, 2 D'ish	Co-operative	J. H. Peters	12	2 Stations.
Rice ....Webster	85	2 Imp. Sharples.	Co-operative	O. M. Olson	10	1 Station.
Scott ....Jordan	40	1 Acme.........	Private	J. A. Zettel	12	
Scott ....Chaska	70	2 Stand. Sh'pls..	Private	Samuels & White	8	New.
Sibley ....Arlington	210	Gather cream...	Corporation	E. G. Potter	8	
Sibley ....Henderson	150	Gather cream...	Private	A. G. Pheoler	12	
Sibley ....Gaylord	85	Gather cream...	Private	Miller Bros	7	
Sibley ....Gaylord	160	Gather cream...	Private	Theole & Son	12	
Sibley ....Gibbon	200	Gather cream...	Co-operative	P. Manderfeld	6	
Stearns ....Avon	20	1 Jumbo........	Co-operative	T. F. Roach	3	
Stearns ....Melrose	105	Gather cream...	Corporation	E. G. Potter	6	
Stearns ......Richmond	160	Gather cream...	Co-operative	J. Tschumperlin	9	
Stearns....Sauk Centre	74	Gather cream...	Stock Co	A. Miller	5	
Swift ....Appleton	100	4 Russians......	Co-operative	P. M. Scott	8	3 Stations.
Swift ....Benson	100	Gather cream...	Private	Mr. Barnes	4	
Steele.....Clinton Falls	59	1 Alpha, 1 D'nish	Co-operative	G. Griffin	12	
Steele ....Havana	60	2 No. 1 Alphas..	Co-operative	John Morton	12	New.
Steele...Bloom'g Prairie	200	4 No. 1 Alphas..	Co-operative	G. A. Petterson	12	
Steele...Bloom'g Prairie	90	4 De Lavel......	Co-operative	S. Petterson	12	
Steele ....Berlin	74	2 Extractors....	Co-operative	T. N. Brown	12	
Steele ....Pratt	120	2 Danish, 1 Imp.	Co-operative	Aug. Voelker	12	1 Station.
Steele ....Bixby	64	1 Alex., 1 Russ'n	Co-operative	N. T. Nelson	9	Burned.
Steele ....Owatonna	75	2 No. 1 Alphas..	Co-operative	W. Glascon	12	
Steele ....Owatonna	70	2 No. 1 Alphas..	Co-operative	S. G. Kinney	12	
Steele ....Owatonna	140	4 No. 1 Alphas..	Co-operative	J. Harris	12	2 Station.

CREAMERIES—*Continued.*

COUNTY AND POST OFFICE.	Number Patrons.	Process.	Organization.	Proprietor or Manager.	Months Operated.	Remarks.
Steele ....Owatonna	60	2 No. 1 Alphas..	Co-operative..	N. O. Partridge	12	
Steele ......Cooleyville	104	2 Acmes, 1 Alpha	Co-operative.....	F. G. Sloan	12	
Steele ....Meriden	48	2 Danish W'stns	Co-operative..	J. W. Andrews	12	Reorganiz'd
Steele....New Richland	28	2 Jumbos.......	Co-operative.......	J. Sulivan	12	
Steele ....Lamond	50	2 Stand. Russ'ns	Co-operative...	Chas. Hanson	10	Reorganiz'd
Steele.....Steele Center	80	2 No. 1 Alphas..	Co-operative...	J. K. Bennett	10	
Steele ....Medford	70	2 No. 1 Alphas..	Co-operative..	B. A. McKinley	12	New.
Todd.......Long Prairie	100	Gather cream...	Private....	Christianson & Co	4	
Todd ....Clarissa	50	Gather cream...	Stock Co....................		3	
Traverse..Brown's Val'y	100	Gather cream...	Private	Scheideimantel	6	
Traverse ....Tintah	35	Imp. Russian...	Co-operative..	W. F. Prescott	5	New.
Wabasha...Bear Valley	48	1 Jumbo.......	Co-operative...	A. D. Stowell	4	
Wabasha ....Hammond	150	Gather cream...	Private............	J. Kelley	8	
Wabasha ......Mazeppa	80	Gather cream...	Private..	W. B. Dickey & Co	11	
Wabasha ....Plainview	330	1 Stand. Russian	Private.........	A. Y. Felton	12	1 Station.
Wadena ....Wadena	70	Gather cream...	Private.......	Hangdahl Bros	5	
Waseca......Alma City	70	2 No. 1 Alphas..	Co-operative...	J. D. Seaman	12	New.
Waseca ....Morristown	36	1 No. 1 Alpha...	Co-operative.....	M. A. Goar	12	
Waseca...New Richland	50	1 No. 1 Alpha...	Dividend.......	H. Jeahnings	12	
Waseca ....Otisco	50	1 No. 1 Alpha...	Dividend,	Bishman & Johnson	4	
Waseca ......Janesville	50	Gather cream...	Private........	L. J. Stewart	8	
Waseca ....Waseca	100	Gather cream...	Private....	M. D. Armstrong	12	
Waseca ....Palmer	40	1 No. 1 Alpha...	Co-operative....	L. J. Larson	8	New.
Waseca ....Waseca	70	2 No. 1 Alphas..	Co-operative......	D. H. Case	12	New.
Washington ....Scandia	40	1 No. 1 Alpha...	Co-operative......	F. J. Lake	6	New.
Washington ...Newport	30	1 No. 1 Alpha...	Co-operative.....	H. A. Jones	3	New.
Washington, Cot'ge G've	25	1 Jumbo........	Co-operative....	J. P. Furber	4	New.
Watonwan .....Madelia	145	3 De Lavel...... 1 Reid, 1 Rus'an	Co-operative....	J. McCarthy	12	2 Stations.
Watonwan .....Madelia	30	1 Danish W'ston.	Co-operative........	G. Drake	12	
Watonwan....St. James	113	2 D'nish W'stons	Dividend...........	F. Gehrls	12	
Watonwan....St. James	42	1 Stand. Russian	Co-operative....	N. J. Nelson	6	
Watonwan ......Antrim	30	1 Sharples......	Co-operative			
Watonwan ......Cereal	40	1 Sharples.......	Co-operative......	J. Erickson		
Watonwan ..Butterfield	42	1 Alpha, No. 1..	Co-operative....	E. Wienecke	8	
Wright ......Monticello	150	1 De Lavel......	Private......	Montanya & Co	8	
Wright ....Rockford	35	Gather cream...	Corporation.....	E. G. Potter	4	
Wright ....Howard	40	1 Imperial.......	Co-operative		5	New.
Wright, Kimball Prairie	25	1 Separator.....	Co-operative.........	E. Peck	..	Building.
Winona ....Bethany	28	2 Stand. Sh'ples.	Dividend.........	J. Streblow	7	
Winona......St. Charles	220	Gather cream...	Private.........	P. H. Keifer	12	
Winona ....Beaver	22	1 No. 1 Alpha...	Dividend.....	Scott & Keifer	3	New.
Winona ....Saratoga	350	Gather cream...	Co-operative.....	E. B. Gerry	12	
Winona ....Utica	258	Gather cream...	Private........	E. S. Hurning	12	
Winona ......Pickwick	60	Gather cream...	Private........	J. T. Whalen	6	
Winona...Rolling Stone	34	1 No. 1 Alpha...	Dividend.......	Scott & Keifer	6	New.
Yel. Med'ne..Wood L'ke	10	1 Jumbo........	Co-operative....	L. B. Hauck	1	
Yellow Medicine, St. Leo	40	Gather cream...	Private..........	F. Anthony	3	
Yellow Medicine...Echo	130	Gather cream...	Private.........	John Hanson	5	

The kind and style of separators used is added for the purpose of furnishing a directory for correspondence between factories as to the relative merits of the different machines, and also for the purpose of opening up correspondence between new factories about to organize with factories having had experience with the different kinds of separators, and I wish to call attention to the fact that we have several dealers in this state, and they all claim to be willing to furnish any separator desired, and it devolves on the purchaser to ascertain for himself the machine he wants, hence the value of such a directory.

From the table submitted it will be seen that there were in operation this year 253 creameries. Of these 92 have been built in the past eighteen months. In addition and in connection with these were operated this year 53 skimming stations. Some 306 separators were used in these factories, consisting of 17 styles and 5 different makes, and 30,000 dairy farmers furnished either milk or cream to them; 149 creameries and 53 skim stations were operated on the separator plan, 87 on the gathered cream plan, 16 use both, 1 only setting the milk at the factory. As to the plan of organization, they are divided as follows, viz.: 150 are co-operative, 72 are private, 7 are stock companies, 16 are corporations, 8 are operated on the dividend plan. It will be observed that of the factories built within the past eighteen months nearly all are separator factories, on the co-operative plan. A large number of private and corporate gathered cream factories having in this same period discontinued business, or been supplanted by co-operative separator plants; hence we have made our advance more in methods and organizations than in number of factories.

It will also be noticed that at present 60 per cent of the creameries have adopted the separator process, as compared with 45 per cent operating under this process one year ago. I would also call attention to the fact that 60 per cent of our creamery organizations are now operated on the co-operative plan, as compared with 42 per cent of them, operating on this plan a year ago. This indicates that the co-operative plan is growing rapidly in favor with Minnesota dairymen, and indicates to me that we have the advantage over all other dairy states of a system that is sure to keep us in the front ranks, avoiding the dangers occasioned by a few adventurers having control of the whole enterprise, and manipulating it to suit their purposes, or increase their present gains at the expense of future prosperity, both of themselves and the industry.

We are apparently developing into a butter producing state, cheese, for the time, being nearly lost sight of; I suppose for the reasons that the by-product is more valuable from butter making; that it is more of a winter business and prompter returns are obtained for the goods.

Commissioner Ives' report for 1890 gives a list of 129 cheese factories, in operation that year, and though we have advanced rapidly in dairying, we can hardly count one-half of this number of cheese factories at present. How much we have improved in quality in this same period is hard to tell, but evidently there is still plenty of chance for improvement.

The quality of butter made in our factories varies somewhat, and could easily be divided into three general classes: fancy, fine and choice. The large bulk of it coming within the intermediate class, while the proportion of the higher class is considerable, and too much has to go into the lower class, and while our average quality is high there are many factories where chances for improvement exists. I can only give an idea of quality generally from the fact that my visits were made at the different factories at different seasons of the year, and there might be an injustice done by publishing qualities found at each factory under such circumstances.

Minnesota butter, at the world's fair, will verify my statements of quality, as we scored the highest averages there in two different exhibitions, and I have no doubt that had the proper exertion been made, we could easily have continued this record throughout the entire exhibition, which would have been very desirable and valuable.

As to the second of these objects, I am pleased to report that I found the creameries (with few exceptions) clean and neat; that a large majority of them are well constructed and equipped for carrying on the business in a neat, orderly way; the patrons delivering clean, wholesome milk, and that very few adulterations occurred here. In this connection I wish to say that at several co-operative creameries the management does not properly support the butter maker in refusing dirty, unwholecome milk. One case in particular, where I condemned the president's milk as filthy, the secretary undertook to uphold this dirty patron. Such operations as this will surely result disastrous to the enterprise. I give here a list of a few of our first-class factories. These all having first-class equipments, first-class butter makers, clean patrons, and make not only a fancy grade of butter, but they receive only clean, pure milk, and handle their business from beginning to end in the very best possible shape. There may be others entitled to this same record, and if so I hope they will be properly listed in future reports of this commission:

MODEL FACTORIES.

County.	Postoffice.	Manager.	Buttermaker.
Brown	Madelia	John Moe	E. S. Brubaker
Freeborn	Manchester	C. H. Flint	D. B. White.
Kandiyohi	Grove City	C. C. Reitan	B. Walter.
Meeker	Rosendale	Geo. Welch	C. H. Schock.
Meeker	Litchfield	H. Ames	H. T. Sondergaard.
Mower	Austin	C. D. Belden	Frank Parks.
Olmsted	Byron	J. R. Webb	E. E. Simes.
Rice	Webster	O. M. Olson	J. Le Voscente.
Steele	Havana	John Morton	P. M. Paulson.
Steele	Blooming Prairie	G. A. Petterson	Geo. Johnson.
Steele	Owatonna	W. Glascon	Geo. Parks.

As to my third object.

First. I explained and advocated the Babcock test as the best method for adjusting dividends, and preventing frauds. Second, in giving advice and instructions I had in view the contemplation of the law to produce a clean, wholesome product, and acted in the following manner, viz.:

I examined the butter to ascertain if it had a good wholesome flavor; if it was free from milk and evenly salted (as these are the indications of cleanliness and wholesomeness), and detecting any defects in this respect, I set about to discover the cause and indicate the remedy, never forgetting to impress upon the maker the importance of seeking the best information possible from the proper instructive sources.

In making this tour of inspection I have had an opportunity to note the results from all the different plans and processes used in connection with the manufacture of butter in this state, and as a result of this opportunity I submit the following propositions:

First. The finest and cleanest butter made is produced by the separator system.

Second. The quickest and best way to advance the dairy interests is through a well organized creamery system.

Third. In Minnesota the co-operative separator creameries are the most successful and most profitable to the producer. In view of these facts I would recommend the organization of co-operative separator creameries in all localities where a sufficient number of cows now exist or can be secured. In localities where this is impossible the producer should secure for himself a small separator, whether he intends to furnish cream to a factory or manufacture his own product on the farm.

It is only the expense and an ignorance of the real merit of these machines that retard their universal adoption. There are already quite a number of these hand separators in use in our state, one firm alone claiming to have sold over 300 of them within the state.

While some of the separators now on the market are really worth the prices asked for them (from results obtained), such prices are unreasonably excessive, and check their use, and therefore retards the advancement of dairying to a great extent; but I hope the time is near at hand when natural competition between manufacturers and dealers will reduce these exorbitant prices to reasonable ones.

There is no reason why the most ordinary dairy farmer in Minnesota may not become very efficient in butter making, even at home on the farm.

This state now has four organizations laboring in this direction, and they distribute systematically and continuously printed information which, if read by the masses as it should, and is calculated to be, and heeded, would add millions of dollars annually to producers' profits, and supply our markets with a very different article from that now classed as farmer's or store butter, which is now used almost exclusively for cooking purposes, and some even for soap making.

The dairy school, the state dairymen's association, and the state farmers' institute are organizations of instruction, and are doing a large amount of good work in this direction; the state dairy and food commission, while not supposed to be an instructive organization in the same sense as the others mentioned, has the same objects in view, namely, the advancement of the dairy industry, and is willing and glad to give all the information and help it can towards the upbuilding of this industry.

My fourth object, looking for losses in the process of manufacture, I found to prove very valuable to many factories. I found, in some cases, over 20 per cent loss of the entire product in separating and churning. In many cases a slight adjustment of the separator, and a few instructions or suggestions as to ripening cream and churning overcame most of this loss at once. In a few cases I found it necessary to advise them to discard the separator in use for a more perfect machine. The greatest trouble is that the butter maker (being often overburdened with work and going through the same routine daily), is inclined to become thoughtless, or careless, and does not notice slight changes in his separator or in handling his cream until some day he is surprised to find he has been running so careless; he knows better generally, but he doesn't think, and very often has so much work he has hardly time to sleep, much less to think. I would recommend to managers that they make and enforce a rule requiring the skim milk from each separator and the butter milk from each churning tested each and every day, and the results recorded, as well as all conditions (in cases of excessive losses).

I also did considerable work in testing separators to ascertain if any losses in skimming, and found losses occurring frequently with all kinds of separators, but generally a slight adjusting of such machine would overcome the difficulty.

Most of this separator testing was done by special request of the creamery manager or butter maker; tests seldom being made where the separator was doing satisfactory work. I think it will be interesting, and perhaps instructive, to give a table showing a record of all tests of separators made by me.

I call particular attention to the fact that these results are not obtained under expert skill with these separators, but were taken from the machines as actually operated in the factories at the time of my visits, and are recorded full, and unreserved, and without predigest.

NAME OF SEPARATORS.	Number Tes. ed.	Number of Tests.	Average Speed.	Average. Temperature.	Capacity Per Hour.	Per Cent taken as Cream.	Per Cent. of Fat Left in Skim Milk
Jumbo, large..........	5	8	6,937	83 deg.	2,111	11.5 per ct.	.27
Alex. Jumbo......... ...	5	9	7,000	81 deg.	2,110	26.0 per ct.	.40
Danish Weston........	2	3	4,400	79 deg.	1,700	Heavy.	.33
Imeperial Russian.....	4	9	7,544	82 deg.	2,105	23.0 per ct.	.33
Imp. Sharples Belt.....	3	3	7,633	87 deg.	1,172	20.0 per ct.	.15
Standard Russian......	2	3	7,500	79 deg.	1,170	Heavy.	.26
Stand. Sharples Belt..	1	1	8,400	83 deg.	1,380	22.0 per ct.	.05
Alpha No. 2 Belt......	1	1	6,000	80 deg.	3,100	10.0 per ct.	.10
Alpha No. 1 Belt......	4	6	5,800	72 deg.	1,976	Heavy.	.08
Alpha No. 1 Turbine..	2	2	5,550	73 deg.	2,000	Heavy.	.15
Acme Belt	1	1	6,200	80 deg.	1,110	19.0 per ct.	.00
De Lavel Belt.........	2	5	7,100	78 deg.	1,020	Thin.	.06
Totals	32	51	6,672	80 deg.	1,746	19.0 per ct.	.18

THE DAIRY SCHOOL.

Through the courtesy of the governor and yourself I was allowed to fill the position of instructor in butter making at the Minnesota Dairy School during the January term of 1894, and therefore think it proper to report this branch of my work. This school is a branch of the University of Minnesota, and was organized in 1892, and has been a grand success from the beginning, both as to quality and attendance. The object of this school is to broaden the education of the factory butter and cheese makers by teaching them branches of the dairy business that is impossible for them to pick up elsewhere, including breeding, feeding, selecting stock, and in fact all things important for them to know in the dairy line.

We claim that a butter maker is not competent to make a commercial article of butter until he knows just what a commercial article is; hence we learn him to score, or judge the different kinds of butter.

It is also very important that a maker knows the constituents of the article he is handling, all the conditions that affect it, and how they affect it; he must understand these things before he can thoroughly understand testing, separating, cream ripening or churning; and these he is taught, both from a practical and scientific

The object of this school is not to turn farmers or artisans into butter makers in one month, but is calculated to bear the relation to the butter makers that the summer training schools bear to the teachers.

It requires experience as well as education to make a first-class butter maker, and it is desirable that at least a part of the experience precede the education. Therefore I am of the opinion that an experience qualification should be required of all applicants to this school, and am assured that this will likely be adopted hereafter. It is my desire also to see this department, the dairy school, the state dairymen's association and the state farm institute corps, working together in complete harmony, and I am gratified to note that at the present time very little friction exists between them, but there should be none, as any petty jealousies injures the valuable work of all to some extent.

I am also of the opinion that a butter maker should be required to obtain a certificate of skill and experience similar to those granted engineers or school teachers, before being allowed to operate a co-operative factory, as the prosperity of a community is, to a great extent placed in his hands. I am not prepared, however, to suggest just how this plan should be matured, but I wish to call attention to it, and I believe we are ready to take this advanced step.

THE VALUE OF MILK.

The value of milk for butter making depends entirely upon the amount of fat it contains, and on this basis only can its value be determined, or dividends equalized. Nearly all creameries in Minnesota have adopted the Babcock test, which is correct and seemingly very simple, though it requires some experience and considerable skill to operate it successfully; the greatest difficulties encountered are in obtaining a correct sample to operate on and securing good

THE BABCOCK TEST.

Great care should be exercised that the sample taken from each delivery of milk fairly represents it. There are several ways in which this can be done reasonably accurate; stirring and dipping from the weigh can; catching sample as it leaves the weigh can (if a large quantity two-thirds should be allowed to run out before catching the sample). The best way is to insert a long tube from the top to the bottom of the weigh can, as this insures more accuracy; however, the main object is to use a uniform method on all receipts that dividends will be divided equally. Great care should also be taken to preserve the samples in a good mechanical condition up to the time of making the test, and for this purpose I would advise using Prof. Patrict's combination, consisting of one part corrosive sublimate and four to eight parts of bicromate of potassium, the smaller the dose the better, provided it is sufficient to keep them. The samples should be kept sealed as completely as possible, and a very good plan is to have them in portable racks and transfer to the refrigerator in either extremely cold or warm weather. So much trouble is experienced in getting clear tests that I want to add the following: Be sure your acid is good, that your machine has plenty of speed, and that the water is clean and hot, and you will generally get good results.

ADJUSTING DIVIDENDS.

There should be some uniform method adopted for adjusting dividends, especially among co-operative factories, which would admit of comparing results with one another. Under the present systems this is impossible. One patron says I got 25 cents for a pound of fat, another says I got one dollar per hundred for milk, another says I got 25 cents for a pound of butter made. How can results be compared under such circumstances? Very often the test is manipulated, or a figurative price per hundred is given out, to cover up the defects of the maker or management; hence we find that in certain cases the churn falls short of the test, while in others it overruns as high as 30 per cent, some paying a big price, others giving a big test. I would suggest that the overrun be added to the test, and each patron be paid a price based on the amount of milk (delivered by him) required to produce a pound of butter. This would furnish a basis of comparison, and be an incentive to extraordinary effort on the part of the maker. It requires an incentive for extraordinary exertion, and one furnished in this way would bring many a creamery up to better dividends.

I hope this suggestion will be put into practice, as it will surely be an advance step besides being easily understood by the patrons.

THE SEPARATOR.

It is very important that a creamery has a good separator. This has been recognized by a few factories to the extent of setting aside practically new machines costing $500, and buying of other styles, claiming this was the only way they could pay dividends equal to their neighbors, and make a success of their enterprise. A good separator is a machine that will separate the cream thoroughly from the milk at a reasonably low temperature and do the amount of work claimed for it, and do this without running at a speed greatly in excess of that calculated that it should run. It is also important that the proportion of cream and milk can be adjusted, and it should skim thoroughly clean from start to finish, and not clog up during a few hours' run. The only safe way to purchase any make of separator is on a trial of at least thirty days, subject to the above qualifications, and have the testing done by competent, disinterested parties. There are machines of all makes and styles that will not prove perfect or desirable, as some machines are much better than others of the same make and style.

THE BUTTER MAKER.

The success of all creameries depends to a great extent, and in many cases entirely, upon the butter maker. It therefore behooves the management of creameries to be very careful in selecting a competent person for this position. A few dollars per month extra salary amounts to nothing compared with securing a first-class maker.

A butter maker should not only understand handling the tests, separator, cream, butter and machinery, but should be able to give proper instructions to patrons in reference to selection of cows, feeding, care of milk and cans, and should have a good idea of creamery bookkeeping, be a good judge of butter and well acquainted with the principal markets. These qualifications can only be obtained by experience and study, and the maker who does not keep himself posted up to date should not be continued in the service.

SUNDAY OPERATING.

Considerable discussion has taken place through our dairy papers as to whether it is necessary or right to operate creameries on Sunday. I wish to start out with the proposition that, if it is not necessary, it is not right. I do not believe it is necessary, for the reason that it is possible to hold milk over two days in good condition any weather, and without resorting to extraordinary methods, cleanliness and airing of milk being all that is necessary. Sunday operating has been carried on in some of our neighboring states, until they begin to claim it a necessity, similar to any other habit formed. I am opposed to operating on Sunday for the following reasons, viz.:

First. It is unnecessary.

Second. It is demoralizing.

Third. It is a disturbing factor in a neighborhood (being objectionable to many on religious grounds).

Fourth. It is expensive, making an extra day's running expense each week.

Fifth. It obliges the butter maker to work seven instead of six days each week, and on this ground would drive the best men from the profession.

Sixth. Being unnecessary is in violation of the state laws of Minnesota.

Nothing that I can conceive of would do more to create dissatisfaction among the stockholders of a co-operative creamery than Sunday operating, and most of our co-operative organizations realizing this have ruled imperatively against it in their by-laws, and I want to advise any co-operative organizations that have not provided such a by-law, to add it at once to theirs. I do not take this stand on religious grounds, but on general principles, and to try and keep out a bad disturbing element.

EXHIBITING PRODUCTS.

There is a chance of much good resulting to factories from the exhibition of their products at places of public interest, such as fairs, state, district and county, also at dairy conventions of all kinds, and in fact any opportunity offering for displaying or comparing products should be taken advantage of. It not only helps in establishing a reputation, but calls attention to the defective points of the product, and a maker exhibiting a few times learns the requirements of the markets, and can govern himself thereby. Nearly every exhibition organized offers inducements in the way of premiums for the best products exhibited, and it is surprising to me that more attention is not given to this most excellent opportunity of obtaining a reputation and gaining the information it furnishes.

ORGANIZING CO-OPERATIVE CREAMERIES.

I think it not out of place to outline a plan for organizing co-operative creameries. Call a preliminary meeting and obtain the presence of all farmers possible within a radius of six to ten miles, and after having some capable person explain to them the advantages and disadvantages of such an enterprise, have each one sign an agreement pledging himself to join the organization and supply milk from a certain number of cows. When 300 cows are thus pledged, organize these signers into a creamery association under the general laws of 1870, chapter 29th, sections 1 to 12 (this law is very favorable for such organizations), after which address the several resident creamery supply dealers for plans, specifications and prices, and make a contract for a substantial well equipped plant with the best apparatus, and with a capacity in accordance with future prospects. When started, get all the milk possible, either from stockholders or non-stockholders, and be sure and elect a good business man for secretary and manager, and delegate to him the whole control of the business, with the assistance of a good butter maker.

SKIMMING STATIONS.

Skimming stations as a rule have not proven desirable, and in many cases very disastrous. The expense necessitated in delivering the cream to the churning station and the injury from transporting it are the general causes. Where there are a sufficient number of cows to insure a good station run, there are plenty to justify the building of a creamery, and the creamery will prove more economical, and give better results and satisfaction than a station possibly can. There may be exceptions to this (as there are to all rules), but experience will bear me out on the general statement. I call attention to the fact that very few stations have been built this year, while last year there were a great many built.

CREAMERIES IN FREEBORN AND STEELE COUNTIES.

The two small counties named above (lying in the central southern part of the state) appear to possess no great natural advantages over most other parts of the state. However, they entered into the dairy business on the co-operative plan some four years ago, and finding it a profitable industry, extended it very rapidly until now these two counties are thoroughly organized in this co-operative dairying, having 41 creameries, all co-operative, and well distributed. The result has been that in these two counties the panic of 1893 and 1894 was not felt to any great extent, and they are assured a liberal income from this source (amounting to over one million dollars annually for the past two years for their butter product alone), besides being provided with rivers of skim and buttermilk with which to successfully engage in pork raising. Their lands are becoming more fertile instead of being run out, as is the case in nearly all other kinds of farming. These two counties illustrate what can be done for other portions of this state on these same lines.

OVERPRODUCTION OF BUTTER.

There is no danger for generations to come of producing a surplus of fine butter. Never before was table butter so scarce as at this time, and it is almost impossible, and entirely improbable, that the supply of a fine article will exceed the demand for it at profitable prices within a decade, for cows cannot be bred fast enough to produce such a quantity of butter as this would require, as with the reduction of the cost that will follow the increased production, consumption will increase very rapidly, until the people will not only use butter on bread, but on all kinds of meats, potatoes, and in all kinds of cookery, it taking the place of all other kinds of fats, as it possesses better qualities than any of them do or can.

QUANTITY OF BUTTER MADE IN MINNESOTA IN 1894.

In our advance report I gave the estimate amount of butter made in 1893 as 36,000,000 pounds, divided as follows, viz.:

19,000,000 pounds made in the creameries worth 21 cents per pound.

7,000,000 pounds made in the dairies worth 15 cents per pound.

10,000,000 pounds made in the dairies worth 10 cents per pound.

This year nearly all creameries reported an increased make, ranging from 5 to 50 per cent up to about June 15. The dry weather then showing its effects, caused a decrease from that time on, but on the whole it appears that the average make of creameries for this year will be fully equal to last year's make, adding to this the amounts made in the new factories would bring this year's make up to about 23,000,000 pounds, which I consider a fair estimate. The make of dairy has decreased considerably, most of the decrease being in the poor grade, and any figures I am now prepared to give would be so unreliable that I will not venture an estimate on this product, but one thing is certain and gratifying that the material for a large quantity of this poor butter now goes through the creameries, and other large quantities have been improved in quality, making low grades comparatively scarce at present in Minnesota.

OUR DAIRY INTERESTS.

The amount of capital invested in the dairy industry in Minnesota is something like $20,000,000. Some 30,000 farmers supply milk and cream to factories, in addition to private dairy interests. The income from this source is over $8,000,000 annually, and it is safe to say that over 500,000 of our people are directly interested in this enterprise, and it is not surprising that the attention of the whole state is now directed towards the dairy interests. In the face of this it is not unreasonable to demand that legislation most favorable to its growth and protection be enacted and enforced as the prosperity of all classes and occupations seem to rely upon it to a considerable extent.

I deem it unnecessary to include in this report my inspection of dairy stables tributary to our large cities, neither to relate my experience with, nor part taken in oleo, filled cheese and other miscellaneous inspection, as the reports and records being compiled by Secretary Bertram will no doubt cover this, and show my connection and interest in these matters. I therefore submit this report of work done by me, and hope it will meet with your approval and the approval of the dairymen of this state.

E. J. GRAHAM.

REPORT OF THE STATE CHEMIST.

E. N. Eaton, M. Sc.

St. Paul, July 31, 1894.

Hon. Berndt Anderson, State Dairy and Food Commissioner. Sir:

In submitting the chemical work of the biennial period just closed, I take this opportunity of outlining the plan of work pursued, and the method of presentation in this report, and also to emphasize some suggestions I consider important elucidated in the body of the report.

It has been necessary to change in some important particulars the method of inspection and analysis employed in previous years. To analyze indiscriminately all food products brought into the laboratory would require a force of chemists larger than the number of inspectors. So when a brand of goods was once analyzed and found to be pure, other samples of that brand were not immediately analyzed. Inspectors were furnished with the brands or make of goods which on analysis proved to contain adulteration. These goods, as well as new brands, were sampled at every opportunity. In this manner the quality of goods upon the market can be better ascertained; the moral result of inspection is secured; while better than any other way, if inspection records are correctly kept, can the actual percentage of adulterated goods over the entire state be obtained. Another important advantage of this procedure is that it enables the chemist to make complete analysis of articles of adulterated food. Hence, no mistake can easily occur. The use of a small amount of an adulterant may be detected and exposed. The complete chemical analysis is always desired as evidence in court, and is absolutely necessary in contested cases. In the last two years we have been fortunate in this respect, as not one case in court has been lost depending on proof of adulteration as established by expert testimony. Thus, while increased effectiveness is obtained, an economy in time and labor is secured.

In describing the various articles of food and their adulteration, I have endeavored to keep out of the beaten path. In case the subject was adequately treated in previous reports I have recorded simply the recent acquisitions to our knowledge of the subject.

Inasmuch as filled cheese, honey and vinegar have been but briefly mentioned in previous reports, I have enlarged upon them somewhat fully.

In considering milk in its sanitary relations I wish to call attention particularly to the subject of bovine tuberculosis; its diagnosis with Koch's "lymph" and means of eradication or checking the insiduous disease. This subject is not asking but forcing its attention on the public.

In view of your recommendation of pasteurized milk, methods of pasteurization and sterilization on a large and small scale are given.

Our state standard for fat in cheese is low—too low. Cheese made in part from skim milk may easily, under the state regulations, be sold as "Minnesota full cream cheese" and so labeled. The discussion of this subject and my conclusion as reprinted from the advance sheets of this report was concurred in by a number of chemists from other states.

For the benefit of vinegar manufacturers I have written a description of an accurate method of practically determining the acidity of vinegar to the end that the vinegar on the market may more generally come up to the state requirement.

As is done in some other states, but not heretofore by this department, I have published the names of the producer and seller of adulterated articles along with the analysis.

As a rule the analysis is recorded only of adulterated articles. An exception is made in the case of cheese, the reason for which will become evident in reading the report upon that food.

The general result of the analysis may be summarized as follows:

Article of Food.	*Number of Samples Inspected.	Number of Samples Analyzed.	Pure or of Standard Quality.	Adulterated or Illegal.	Percentage of Adulteration.
Milk	....	159	53	106	....
Cream	....	1	....	1	....
Colostrum	....	1	....	1	....
Separated milk	....	2	2	..	....
Butter	....	235	182	53	....
Cheese	711	518	468	50	7.0
Lard	428	98	59	39	9.1
Vinegar	1,192	697	470	227	19.0
Baking powder	1,327	41	26	15	1.1
Cream of tartar	....	2	1	1	....
Water, mineral	....	2	2	...	....
Water, sanitary	....	4	4	...	....
Pepper	....	2	1	1	....

Article of Food.	*Number of Samples Inspected.	Number of Samples Analyzed.	Pure or of Standard Quality.	Adulterated or Illegal.	Percentage of Adulteration.
Malt beverages	....	15	15	...	....
Honey	149	51	33	18	12.0
Maple sugar	....	1	1	...	....
Lard substitutes	82	....	....	...	....
Total	.....	1,829	1,317	512	....

---

*Furnished by Assistant Commissioner.

MILK.

The average quality of milk sold in the state is encouraging. Not only has there been a decrease in adulteration, but the milk has run unusually high in those constituents that make it of value as a food. This increase in fat and solids may be due in part to the dry season, yet a prime cause is found in the comparatively high standard for milk enacted by the legislature of Minnesota and the rigid enforcement by the commission. Thus law, acting through judicious breeding, feeding and keeping, can and does enhance the value of our food products.

At this time little will be said regarding the formation, composition and chemical analysis of milk. This has been well covered in the chemists' reports of previous years. A few remarks may not be irrelevant upon some recent acquisition to our knowledge touching the dairy interest.

Citric acid has been found to be a constant ingredient of cows' milk. It is also found in considerable quantity in human milk, and the milk of mammalia in general. The acid, of course, is not in the free state, but in the form of the calsium salt. It is estimated that in one gallon of cows' milk there is the equivalent of two lemons. According to Herz there is found in milk, butter and cheese a substance which in size, form and chemical properties closely resemble starch, and which he calls "amyloid." "Whether or not these amyloid bodies always occur in milk, and whether they have any importance in connection with the manufacture of milk products, are questions for future study."

The phosphates of milk have been studied by Duclaux. He states that phosphates exist in milk in soluble and insoluble forms. The insoluble phosphates consist of phosphates of iron, alumina, magnesium and calcium. The soluble portion appears to be a mixture of tricalcium phosphate, sodium phosphate and sodium citrate. The insoluble portion contains about twice as much lime and calcium phosphate as the soluble portion. The author found that so-called phosphate milk, or milk supposed to have been increased in phosphates by feeding phosphate of lime, contained no more phosphates than other milk. The close agreement of the mineral constituents in the milks analyzed suggested that the addition of either soluble or insoluble phosphates to milk could be detected from the change it would cause in the relation of the soluble to the insoluble (suspended) phosphates.

A. Sartori reports finding surphur to the extent of 0.043 per cent in cows' milk sold for infants. The milk was delivered in corked bottles and was examined about six hours after milking. The author is in doubt as to whether the sulphur found is entirely accounted for by that in the casein.

The nuclein content of milk has been studied by Szontagh. By artificially digesting cows' milk the author obtained regularly a nuclein containing 2.97 to 3.5 per cent of phosphorus. By continued digestion the nuclein diminished in amount and the phosphoric acid was recognized in solution. Nuclein could not be prepared from human milk by any known method. The author concludes that the casein of human milk differs from that of cows' milk by not containing any nucleo-albumen.

In a study of the proteids of cows' milk, A. R. Leeds corroborated Duclaux's statement that casein was separated by filtering through a porcelain filter, and found that a large part of the lactalbumen remined on the filter. Both substances are in milk in colloidal form; only the starch-liquefying ferment galactazmase is in true solution in milk.

Prof. Babcock a few years ago demonstrated that there existed in milk an albuminoid analogous to blood fibrin and proposed to call it lacto fibrin in order that it may be distinguished from fibrin of the blood.

It is difficult, if not impossible, to determine the exact amount of lacto fibrin in milk, but it is present in extremely minute quantities, not more, Prof. Babcock thinks, than two to three-thousandths of one per cent, and the amount may be considerably less than this. As small as is the amount of this substance in milk, its property of spontaneous coagulation in at ordinary temperatures make it extremely probable that it exerts a marked influence upon the efficient creaming of milk by the gravity system. Lacto fibrin is one of the ingredients of separator slime.

Milk when fresh drawn has a so-called "amphioteric" reaction. alkaline reaction with lacmoid and an acid reaction with phenolphthalein, but that the reaction is more marked in cows' milk. Casein forms three compounds with calcium or sodium, all of which are alkaline to lacmoid and neutral to phenolphthalein and are decomposed by water. The decrease of milk in acidity when diluted with water is a result of the decomposition of the calcium-casein compounds and the phosphates. The decrease in the alkalinity is caused only by the presence of calcium-casein compounds. By cooking, the alkalinity and the acidity of milk are both reduced. The change in the casein caused by adding rennet to milk has no connection with the reaction. In curdling with rennet the dicalcium-casein compound is precipitated.

J. Sebelien states that the alkaline part of the amphoretic reaction of milk to litmus requires to neutralize it from 0.2 to 0.5 c. c. of decinormal sulphuric acid per 50 c. c. of milk. The alkalinity is often greater towards the close of the milking period. The acid part of the reaction to litmus required from 3 to 5 c. c. of decinormal alkali per 50 c. c. of milk. The "relative acidity" towards phenolphthalein he finds equal to 10 to 11 c. c. of decinormal alkali usually. Toward the end of the milking period it may sink to 8 to 10 c. c. In colostrum the acidity was equivalent to 15 to 19 and even 21 c. c. of decinormal alkali per 50 c. c.

Vaudin has given much study to this question of the reaction of milk. He finds all milk acid to phenolphthalein and that the acidity in the case of the same animal varies within narrow limits under the influence of the food. All factors which disturb milk secretion, as pregnancy, food, etc., affect the acidity. The acidity increases slightly as lactation advances and the time for calving approaches. The milk of rapidly maturing animals, as the cow, goat and sheep, is more acid than human milk and that of slow-growing animals, as the mare and ass. The author affirms that the acidity is due largely to the acid properties of the proteids and bears a close relation to the amount of salts in the milk, especially calcium phosphate. The variations in acidity which occur during the period of lactation depend upon simultaneous changes in the nature and relative proportions of the various protein substances and the mineral elements of the milk.

Immediately after milking the milk commences to change in composition, the sugar of milk being converted into lactic acid. Not until the milk contains from 0.4 to 0.5 of one per cent of lactic acid does the sourness become perceptible to the taste. A milk may be marketable, therefore, which is on the very verge of souring. It was intended to make this summer a somewhat extended investigation of milk sold in the cities, especially train milk, with this object in view, but rush of other work prevented.

A microscopical examination of milk shows the fat to be in the form of an emulsion in the serum. The fat globules are of varying size, some being ten times as large as others. It has been thought until recently that the fat globules entirely determine the color of milk and a number of devices for the determination of fat in milk were based on this principle. It was also at one time thought that the fat globules were surrounded by a membrane of albuminous substances. This view was finally given up as not being sufficiently supported by fact. In 1892 C. A. Cameron advanced another theory. He claims the color of milk is due to the large number of suspended casein coatings of the fat globules and not to the emulsion of fat and proteids. He extracted all but a trace of fat from milk without changing its color. He observes that buttermilk containing .3 to .6 per cent of fat is whiter than whole milk which has been diluted with an equal amount of water.

The Jersey and Guernsey give milk containing relatively more large fat globules than any other breed, while the Holstein milk contains the fewest large gobules.

The conditions influencing the number and size of fat globules have been the subject of an extensive investigation by F. W. Woll. He finds that the size of the globules decreases with advancing lactation and the number in a given quantity of milk increases. The globules in colostrum are somewhat smaller and fewer than in normal milk. Succulent food appears to decrease the size and increase the number of the globules. Oats, bran, and linseed meal also appear to exert a definite influence on the size and number of the globules. Sickness and excitement affect the globules at once. Age is apparently without effect. Morning's milk has larger globules than evening's milk. The first part of the milking has fewer and smaller globules than the last part.

E. Gutzeit (1893) finds no difference between the large and small fat globules in respect to color, specific gravity, melting point, index of refraction, volatile fatty acids or other chemical properties.

The last year has been especially prolific in literature pertaining to the effect of feed upon the yield and composition of milk.

From various authors and personal investigation the following is summarized:

The fat of milk of individual cows with the same conditions varies from day to day. Weather has but little effect upon the quality and quantity of milk. A change from pasture to stable increases both quantity and quality, more noticeably the quantity. Breed and individual characteristics influence the composition of milk more than other factors, the Jersey usually giving the highest percentage of fat, and the Holstein the lowest. On the other hand the Holstein gives a much larger quantity of milk than the Jersey on the same feed. It is well known that as the period of lactation advances, the yield of milk is less in quantity. It is equally patent that the quality is improved. This is plainly shown in an analysis of Jersey milk sampled from the last milking before going dry.

Total solids	28.43
Fat	14.67
Solids not fat	13.76

The total amount of fat produced decreases as the period of lactation increases. There can be no definite rule as to the relative richness of night and morning milk. Sometimes the morning milk will be the richer, and vice versa. It depends upon the time between milking, the season of the year, the exercise of the cow and the food. The last portion of the milking is much richer than the first. In fact, the "strippings" approach cream in composition, while the fore milk is nothing but skimmed milk, and is so regarded by the court. By milking often (three or four times a day) a larger total of fat will be obtained, but it is doubtful if this gain would be a permanent one.

J. W. Robertson is authority for the following: "The teaching of experience points to the economy of providing for milch cows a ration of succulent quality. 2d. Feeding as large a quantity of feed as the animal will eat up clean. 3d. Making the ration of such a gross and bulky composition that not more than from six to eight pounds of meal—the concentrated and expensive part of feed—will be consumed by the ordinary cow per day. Corn silage is not in itself a complete or suitable food for milch cows."

Contrary to Robertson, the Vermont and Iowa experiment stations do not find that watery food makes watery milk. If the dishonest milkman relied on watering the cow and feeding succulent food to dilute the milk the public might rest secure in the enjoyment of wholesome milk without police supervision.

It has until lately been a disputed question whether feed had any marked influence upon the quality of milk, although all have admitted its influence upon quantity. Now it is generally conceded that food influences quality almost as much as quantity of milk produced. The healthfulness, nervousness and general physiological condition of the cow; the milkman and his habits—even the environments of a cow affect the yield and composition of the milk.

The Babcock test marks a great epoch in the dairy industry. After years of labor on both sides of the Atlantic, it remained for a Western man to develop a quick, practical and accurate test of the fat in milk, and in the West we have received the greatest development therefrom.

Cooke suggested the plan of paying for milk according to the fat content; Patrick discovered a perfect preservative, conceived the composite sample and so made the plan practicable; Farrington and others have found that a preservative is unnecessary. Prof. Patrick recommended simply powdered corrosive sublimate (mercuric chloride) with enough "aniline rose pink" to color. The amount of powder that may be held on the point of the blade of a knife, .5 grams, is sufficient for one-half pint of milk. (I have seen fully one-half teaspoonful used for less than four ounces of milk.) As this preservative is a violent poison, numerous attempts have been made to find a substitute. Potassium bichromate (bichromate of potash) has perhaps proven most successful, but it is not yet fully recommended, and besides is patented. Sour and decomposed milk may be made in good mechanical condition by adding powdered dye.

Prof. Patrick has invented a very successful acid measure for the Babcock test. (See bulletin in No. 19 Iowa experiment station, Ames, Iowa.) Most of the larger creameries in the West and in the East have adopted the system of paying by the "test," and it would undoubtedly be more business-like if all should do so.

SANITARY RELATION OF MILK.

Milk in its normal condition is a perfect food. The sale of milk drawn from an unhealthy animal, kept in unsanitary surroundings, or tampered with in any way, is not only a deception but a constant menace to public health. An excellent treatise upon the relation of dairy products to disease may be found in the second biennial report of this commission. Therein is recorded evidence tending to prove that milk is capable of conveying disease when drawn from a cow suffering from a specific epizootic disease, from a tuberculous cow or drawn from an inflamed udder. The question is still open to experimental evidence; yet the important investigations of late years have thrown so much light upon the subject that it is one of the most important, if not the most important, topic of dairy husbandry and hygiene. Therefore supplementary evidence bearing upon the hygiene of cow's milk is recorded.

Milk as commonly found upon the market contains when from five to six hours old something like 1,000,000 germs per cubic centimeter. Usually, of course, none of these are pathogenic. Yet when an abnormally large number of germs are present milk not only sours more quickly but is in fact less wholesome. The "bitter milk" sometimes met with is shown by Bleisch to be due to bacteria. One source of this specia he found to be in turnips washed in foul ditch water. Such turnips when fed to cows developed in milk the bitter taste. The source of "soapy milk" was traced by Weigmann and Zern to straw used for bedding. It is not certain that the microbe present in the straw passed through the organism of the cow into the milk.

O. Caro has shown that milk is not an excellent culture medium for anthrax bacilli, in fact their virulence is lost in 24 hours at ordinary temperatures.

Diphtheria has been thought to be transmitted from animal to man through the milk. Dr. Klein found the microbe (bacillus diphtheriae) in milk after inoculating the cows. C. A. Abbot, however, experimenting on two cows in 1893 with the same object in view, did not succeed in localizing the disease in the udder or in effecting the milk.

It is well known that immunity from disease is in some germ diseases secured by inoculation with the virus producing the disease in an attenuated condition. On this principle is based vaccination as a preventative for acute smallpox. Pasteur has recently successfully treated hydrophobia in man and anthrax in cattle by application of the same principle. It has been shown that immunity from cholera is secured through the milk of inoculated goats. May not this then be one way of securing an attenuated virus in all germ diseases obeying the law, and milk from such animals, instead of being a menace to health, will render him secure from ever having the disease in a violent form?

As important as are the sanitary relations of milk with respect to epizootic diseases all fade into insignificance compared with the danger from consumption. It is proven beyond doubt that tuberculosis in animals and man is due to the same microbe and that the disease is capable of being transmitted from animal to man. It is beyond cavil that the cow is particularly subject to this disease. Late investigation has shown that the disease is more prevalent among high bred cows than had been suspected by the best veterinarians. Physical examination in many cases fails to detect the disease. By the aid of Koch's lymph, a late discovery of that famous scientist, the disease may be diagnosed with almost unerring certainty. An authority states that 50 per cent of the cattle of Holland are affected. The entire herd of 57 animals of the Maine experiment station were slaughtered as a result of a physical examination alone. The New Jersey experiment station herd was found to contain 70 per cent of tuberculous animals. The Wisconsin experiment station killed 22 out of 30 animals, or 73 per cent treated with Koch's lymph. Investigation in Minnesota and Iowa show that the condition is not quite so bad. Still it is alarming enough. There are but two links left in the chain of evidence: Can the diseased germs find their way into the milk? If so, are they capable of producing disease in a healthy person drinking the infected milk?

If the disease in the cows has reached such stage that the udder is affected, there is no question that the bacilli are present in large numbers in the milk. In the disease among cattle as it usually exists in mild form the bacilli in the milk are certainly few and far between, and, it may be stated with reasonable certainty, cannot transmit disease to a healthy organism under the most favorable conditions. Neither are they present in quantity sufficient for their recognition by bacteriological means. Julius Nilson, in a pamphlet issued in July of the present year, discussing the evidence of tubercle bacilli in milk from diseased cows, in part from original investigation, says:

> "In the light of these experiments the milk of a tuberculous cows must be regarded with suspicion until proven pure. It is probably easier to sterilize the milk than to have it examined. It is certainly risky to use it for feeding animals without boiling. It may, however, be safely used as a whitewash on the outside of buildings, as when properly salted it makes a valuable paint. The germs have been found equally in the cream and in the milk, so that we are as open to infection through our butter as through our milk. It is the belief of some physicians that if all tuberculous cows were destroyed consumption would disappear from the human family. This is based on the observation that where cows are absent there is no consumption. By the use of Koch's lymph we are now able to detect twice as many tuberculous cattle as was possible by former methods. Should it prove infallible, succeeding in demonstrating every tuberculous animal (when used in connection with physical examination), we have the means wherewith to test the truth of the belief that human consumption is derived from bovine tuberculosis. Nothing but good can be the ultimate result from an attempt to weed out the tuberculous stock in our dairies, and doubtless the breeder and the dairyman will find it to their highest interest to effect this result as promptly as necessary."

The statement in the quotation that butter as well as milk may be an agency of transmitting disease is hardly warranted by sufficient experimental evidence, although correct from a priori reasoning.

The following from Russel is more in line with experimental evidencc and probability:

> "Products manufactured from milk that may contain limited numbers of bacilli are much less to be feared than the milk itself. Laboratory experiments have demonstrated that in order to produce the disease even in the smaller animals like the rabbit it requires the introduction of a goodly number of germs. Wyssokowitsch found that from 20 to 30 bacilli were necessary to set up a diseased condition in a rabbit even when they were injected directly into the veins. When animals are fed on tuberculous milk it requires a much larger number, and even then failure to infect is often the result. Therefore the probability of a sufficiently large number being incorporated into butter or cheese is so small as to reduce this chance for infection to a minimum.
>
> "With the consumption of milk and possibly cream the question is quite different. Dilution of the milk of a single tuberculous animal with that of an otherwise healthy herd would doubtless reduce the probability of infection very greatly, as has been repeatedly proven, but no one desires to risk a possible chance of infection where human life is at stake. For this reason it is highly essential that dairymen at least should adopt the tuberculin test as a guarantee to their patrons that there is no possible chance of disease lurking in their herds."

The only remedy proposed is indicated in the passages quoted. Diagnose all herds by use of Koch's lymph or "tuberculin." Kill or isolate such animals as show the reaction. Buy only such animals as the test indicates free from disease. Keep the herd in good sanitary condition. Control from time to time by the test. This is a radical measure. It may require special legislation and remuneration for condemned animals. As the race has existed for many thousand years without the tuberculin test or the knowledge that tuberculosis was caused by germs, or even that there existed such minute life as microbes, there is perhaps no rush in adopting the radical measure until there remains not the slightest doubt that the danger is real, not imaginary, the "test" infallible, yet not so supersensitive as to condemn sound or practically sound animals.

It will require time to educate the public to a true sense of the danger. When this knowledge is diffused among the people they will give a true verdict on the case, and there will be no difficulty of accomplishing the desired result with or without legislation. Until that time, or until the advocates of the measure offer some practical plan of carrying it out, we have in our hands a method which, while not a remedy for the trouble, counteracts its effects. The method not alone renders harmless milk from tuberculosis cows, but from all germ diseases and unsanitary surroundings. It may not render milk wholesome or healthy if chemical antiseptics or alkalies are added. The method to which I refer is "sterilization" or "pasteurization." There is a distinction between the terms not as well recognized as it should be. Sterilization consists in so treating milk that it will be entirely free from germs. Pasteurization consists in so treating the milk that it will be only partially germ free, but free from pathogenic germs. The term "pasteurization" was originally applied to the treatment of wines, but as the same process may be used in checking fermentation in milk, for want of a better name perhaps, the same term is used. Milk may be partially or completely sterilized by a number of methods.

1. Heat.
2. Refrigeration.
3. Alternate heat and cold.
4. Electrolesis.
5. Compressed oxygen.

Heat is as efficient as any method and the most practicable.

If high enough temperature is attained the germs are all killed. A lesser heat on successive days accomplishes the same result. When the heat is conducted at a temperature of from 140 to 160 degrees F. for one-half hour or longer all active germs are usually regarded as killed and the milk said to be pasteurized. In considering the practical efficiency of the process there are two questions involved. Will this heat in the given time kill all pathogenic germs? Is the process prejudicial to milk as a food? 1st, by influencing the taste; 2d, by lessening its digestibility. A temperature of from 65 degrees to 70 degrees centigrade, or 150 to 155 Fahrenheit is very generally held as sufficient to kill all pathogenic germs. The spores are not killed at this temperature, but the most virulent species, as typhoid, cholera and tubercle bacilli do not form spores.

J. Forster and C. de Man found that tuberculosis bacilli were killed in four hours at 55°C., in one hour at 60°, in fifteen minutes at 65°, in ten minutes at 70°, in five minutes at 80°, in two minutes at 90°, and in one minute at 95°. Heating at 55° for three hours, while not sufficient to kill the bacilli, weakened the tuberculosis virus. Heating milk at 65° for fifteen minutes or at 70° for ten minutes is recommended.

When time is a consideration, or a thermometer not convenient, the same object may be attained by heating milk to boiling. Boiled milk, however, acquires a peculiar and to some people not accustomed to its use a not altogether agreeable taste. Boiling certainly destroys the starch liquifying ferment galactimose; coagulates the lactalbumen and changes to some extent the casein and sugar of milk. Raudnitz, Stutzer, Fleischmann, Morgen, Waseleff-Petersburg and others have found raw milk more digestible than cooked. Chavani and Drouet on the other hand find boiled milk more easily digestible than raw. A prominent medical authority in "Lancet" and the Iowa Board of Health recommend boiled milk for infants, skimming off the coagulated albumen.

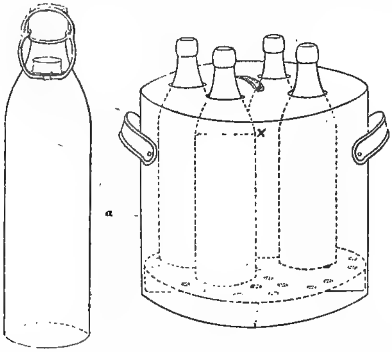
Whatever the effect of boiling milk, it is certain that a temperature of between 60 and 70 degrees C will not impart taste to the milk or appreciably affect its digestibility. It must be remembered that fat in pastuerized milk creams more readily, and therefore should be bought in small quantities or in such quantity as is necessary for immediate use.

The application of the process is simple and requires besides the usual appliances of the kitchen only a fairly accurate thermometer. The milk must be stirred to prevent the milk from scorching and to preserve an even temperature. It would be preferable that the milk be suddenly cooled. Numerous devices for pastuerizing milk on a larger scale are in use from the open kettle of large capacity to much more complicated apparatus, allowing a continuous outflow of pastuerized milk.

C. A. Cary published in January last a method of pastuerizing milk which has some advantages over other methods. Small quantities of milk may be employed; it is beyond possibility from contamination from germs in the air, and will therefore keep longer; is ready for use at any time, and, perhaps the most convenient feature, no thermometer is required.

A convenient vessel in size, made of almost any material withstanding the agency of heat, is fitted with a perforated false bottom, about one inch from the true bottom. The bottles used may be one-half or one pint, and must be of heavy glass and fitted with air tight stoppers.

The so-called "lightning stopper" is probably the best. This stopper is employed in bottles used to dispense carbonated beverages, and such bottles would answer the purpose admirably. The bottles are filled with milk to the point where they commence to taper for the neck. A cover is fitted on the large vessel, leaving openings through which the necks of the bottles may protrude. Cold water is filled in the larger vessel to a point one-quarter inch above the false bottom. The cover being adjusted, heat is applied until the water in the vessel boils from 8 to 15 minutes. If the water comes to a boil slowly 8 to 10 minutes will be enough. The vessel and contents are removed from the stove and let stand 30 or 40 minutes. The milk, if now put in a cool place, will remain perfectly sweet for 24 hours or longer, and be an absolutely healthy food. The milk should never be exposed to the air until ready for use.



If it is desired to completely sterilize the milk, it may be done by repeating the process on three consecutive days. It will then keep indefinitely.

In the summer months it is a difficult problem to transport milk to the cities through long distance in good condition when it reaches the consumer. Fast, through transportation in special milk trains in refrigerator cars have in part solved the problem. There still exists in some places the reprehensible custom of placing the ice in the milk instead of around the cans. It is now proposed to transport milk hot, preferably at 70 degrees C., the advantages claimed are that the milk is not affected by heating to this temperature, does not cream during transportation, is rendered practically sterile, and can be transported long distances to large cities. Special cars provided with heating apparatus are required to keep the milk warm. A practical trial of the scheme on an express train between Hamburg and Berlin proved successful, the milk arriving in good condition.

ADULTERATION.

The adulteration of milk was found to be as in the past largely the abstraction of fat and addition of water. Whenever there is profit in being dishonest people will be found willing to take the chance of detection. Then there are a few who believe in being lawfully honest, and if their milk runs much higher in fat content than is required by law, will add enough water to reduce it to the standard of 3.50 per cent fat. Others would not skim their milk by the usual methods but prefer to save the strippings. Aside from the willful adulteration, perhaps the more ignorant milkman unknowingly sells off the richer milk, as the cream rises to the top and gives the last patron the skim milk. This liability to separation of cream during delivery has, however, been overestimated, as experiments by the N. Y. Experimental station and an excellent German authority show that this will not happen with occasional stirring of the milk in the can and the agitation incident to traveling.

Only such samples of milk as were regarded as suspicious from the inspectors' examination by use of the lactometer and the Babcock test were submitted to a chemical analysis. The report of the inspection will be found in another portion of this report.

A skimmed milk refers to a milk deprived of a portion of its original fat. An illegal milk is one that whether skimmed or normal is below the state legislative requirements in fat or solids. Of the 153 samples analyzed 36 or 23 per cent were skimmed, 41 or 26 per cent watered and 29 or 17 per cent illegal. One hundred and six, or 69 per cent were therefore adulterated. The table will indicate the extent of the adulteration in the individual samples of milk.

MILK ANALYSIS

NAME OF SELLER.	Location.	Solids.	Fat.	Solids, not Fat.	Ash	How Adulterated.
O. F. Chamberlain	Minneapolis	10.43	2.78	7.65	60	Skim'd & watered.
O. F. Chamberlain	Minneapolis	10.44	3.01	7.43	52	Watered.
Jo. Worsenburg	Minneapolis	11.84	2.20	9.64	66	Skimmed.
H. C. Johnson	Minneapolis	10.75	1.60	9.15	61	Skim'd & watered.
H. C. Johnson	Minneapolis	11.31	2.00	9.31	68	Skim'd & watered.
R. Hanson	Minneapolis	11.72	2.76	8.96	68	Skim'd & watered.
R. Hanson	Minneapolis	11.13	2.97	8.16	61	Watered.
H. B. Blood	Minneapolis	11.12	3.18	8.94	61	Illegal.
P. Swanson	Minneapolis	12.84	3.32	9.52	75	Illegal.
P. Swanson	Minneapolis	12.73	3.37	9.36	68	Illegal.
R. Broadquist	Minneapolis	11.45	2.63	8.82	60	Watered.
C. G. Anderson	Minneapolis	10.00	2.04	7.96	70	Illegal.
A. L. McCarger	Dennison	12.33	2.24	10.09	80	Skimmed.
A. L. McCarger	Dennison	11.53	1.90	9.63	80	Skimmed.
B. A. Smith	Dennison	12.12	2.10	10.02	72	Skimmed.
J. E. Orcott	Dennison	12.48	3.00	9.48	86	Illegal.
A. Vangilder	Dennison	12.16	2.40	9.75	61	Skimmed.
M. Crumps	Dennison	11.48	2.47	9.01	73	Skimmed.
H. Goodhue	Dennison	11.86	2.26	9.40	73	Skimmed.
John Miller	Minneapolis	11.06	2.60	8.46	80	Illegal.
John Miller	Minneapolis	11.76	2.52	9.24	71	Illegal.
P. E. Neilson	Minneapolis	11.93	2.40	9.53	79	Skimmed.
Minneapolis Milk Co	Minneapolis	11.69	2.85	9.84	70	Skimmed.
Minneapolis Milk Co	Minneapolis	11.87	2.60	9.27	74	Skimmed.
City Milk Co	Minneapolis	11.50	2.90	8.60	......	Illegal.
Minneapolis Milk Co	Minneapolis	11.87	2.90	8.97	......	Illegal.
Minneapolis Milk Co	Minneapolis	12.00	2.90	9.10	......	Illegal.
C. E. Varnen	Minneapolis	12.95	3.10	9.85	77	Skimmed.
Errikson Bros	Minneapolis	11.93	2.62	9.31	82	Illegal.
Errikson Bros	Minneapolis	11.96	2.61	9.35	71	Illegal.
R. Hanson	Minneapolis	12.40	2.82	9.58	67	Skimmed.
R. Hanson	Minneapolis	11.79	2.40	9.34	74	Skimmed.
J. N. Krohn	Minneapolis	11.50	2.54	....	62	Skim'd & watered.
J. N. Krohn	Minneapolis	11.18	2.50	8.68	66	Skim'd & watered.
Peterson Bros	Minneapolis	11.79	2.29	9.50	77	Skim'd & watered.
H. Simonson	Minneapolis	10.76	1.97	8.79	68	Skimmed.
Herman Fruetel	St. Paul	9.00	2.45	6.55	......	38 per cent water.
J. Kruenze	St. Paul	11.58	2.71	8.87	......	Illegal.
J. G. Christenson	St. Paul	9.18	2.71	6.47	......	43 per cent water
F. Schultz	St. Paul	12.40	3.40	9.00	......	Illegal.
George Staples	St. Paul	10.55	3.11	7.44	60	Watered.
George Staples	St. Paul	9.88	2.61	7.27	55	Watered.
Jas. McGrath	St. Paul	11.92	2.98	7.94	70	Watered.
Jas. McGrath	St. Paul	10.38	2.58	7.80	57	Watered.
John Miller	St. Paul	11.95	3.05	8.90	......	Illegal.
H. C. Larson	St. Paul	11.15	2.00	9.15	......	Illegal.
R. Coaley	St. Paul	12.09	2.83	9.26	73	Skimmed.

MILK ANALYSIS—Continued.

NAME OF SELLER.	Location.	Solids.	Fat.	Solids, not Fat.	Ash	How Adulterated.
E. Coaley	St. Paul	12.40	3.04	9.36	76	Skimmed.
M. Stressty	St. Paul	11.60	3.02	8.40	......	Watered.
Bragg Bros	St. Paul	12.00	2.17	9.83	......	Skimmed.
L. H. Ochts	St. Paul	12.62	2.84	9.78	......	Illegal.
E. Lomdt	Winona	11.80	3.20	9.60	81	Skimmed.
Unknown	Winona	13.43	2.66	10.82	68	Skimmed.
H. Paape	Winona	11.24	1.94	9.30	61	Watered.
H. Fruetel	St. Paul	9.22	2.80	6.42	46	Watered.
Geo N. Welch	St. Paul	10.98	3.00	7.98	......	Watered.
Herman Fruetel	St. Paul	8.14	2.20	5.94	41	Watered.
John Bergman	St. Paul	13.12	3.87	9.25	......	Skimmed.
O. Fethein	St. Paul	11.55	3.48	8.07	56	Watered.
H. W. Hansen	St. Paul	12.94	1.76	11.18	......	Skimmed.
M. Stressty	St. Paul	11.87	3.48	8.39	62	Watered.
N. Welch	St. Paul	11.58	3.06	8.52	62	Watered.
H. Radient	St. Paul	10.37	3.14	7.23	58	Watered.
Enst. Gransher	St. Paul	11.95	3.88	8.07	66	Watered.
Enst. Gransher	St. Paul	11.80	3.82	7.98	64	Watered.
Chas. Timmerman	St. Paul	11.86	3.77	8.09	67	Watered.
H. Radient	St. Paul	10.28	2.71	7.57	59	Watered.
H. Hueffmere	St. Paul	11.70	3.63	8.10	44	Watered.
H. Hueffmere	St. Paul	11.02	3.03	7.99	45	Watered.
F. Errikson	St. Paul	11.30	2.42	8.88	68	Skimmed.
F. R. Peck	St. Paul	11.55	2.89	8.62	62	Watered.
F. R. Peck	St. Paul	11.18	3.16	8.02	64	Watered.
H. Fruetel	St. Paul	10.05	2.72	7.33	49	Watered.
H. Fruetel	St. Paul	10.15	3.21	6.94	52	Watered.
Nick Welch	St. Paul	12.40	3.45	8.95	63	Illegal.
Burch Bros	St. Paul	12.58	3.20	9.38	67	Illegal.
N. H. Pottholf	St. Paul	12.20	2.91	9.29	78	Skimmed.
H. Fruetel	St. Paul	11.68	3.56	8.12	65	Watered.
J. W. Jackson	St. Paul	12.15	2.85	9.30	......	Illegal.
J. W. Jackson	St. Paul	12.31	2.90	....	......	Illegal.
C. H. Parker	St. Paul	10.97	2.13	8.84	79	Skim'd & watered.
C. H. Parker	St. Paul	10.53	2.10	8.43	76	Skim'd & watered.
John Urban	Duluth	11.81	2.65	9.16	80	Skimmed.
Oscar Peterson	Duluth	10.58	2.26	8.32	......	Skim'd & watered.
Thomas Holder	Duluth	11.31	2.91	8.40	67	Watered.
Thomas Holder	Duluth	11.23	3.41	7.82	......	Watered.
Mrs. J. McDonald	Duluth	11.08	2.31	8.77	......	Illegal.
John G. Hager	Duluth	11.50	2.71	8.79	......	Illegal.

CREAM.

It would seem that as low as is our state standard, 20 per cent of fat, no illegal cream should be found. That our standard is low may be seen from the recorded analyses of cream from other localities.

H. D. Richmond, of London, Eng., has summarized 1,368 analyses made in his laboratory in 1892, for the Aylesburg Milk Co. The cream was in all probability raised by gravity, deep setting.

	Per cent fat.
"January	46.3
February	47.1
March	47.0
April	48.3
May	48.3
June	45.9
July	48.5
August	46.0
September	46.6
October	47.1
November	44.3
December	44.2"

Clotted cream often runs as high as 56 per cent fat. The average of American cream, as computed by Hills in 1893, is 18.80. Cream obtained from the DeLaval "Alpha" separator gave 21.12 per cent fat. But few analyses of cream have been made since the last report. The percentage of fat in those analyzed was 8.30, 6.20 and 18.17 per cent—all below the requirements.

	Per cent fat.
Evaporated cream gave	2.40
Condensed milk gave	4.90

Each were manufactured from skimmed milk. There was received in the laboratory this summer a sample labeled cream. From appearances the water had evaporated or filtered out, leaving the residue a semi-solid. The percentage proximate ingredients were:

Water	7.33
Fat	1.66
Combustible fat	90.15
Ash	.85

The combustible portion was found to consist largely of starch or flour, a small amount of albuminoids and milk sugar was present as well as some fat. The cream was then a mixture of starch or flour to which some milk was added.

BUTTER.

It is but the logical result of a cause that a better and more uniform grade of butter is placed upon the market. We have now more complete control of the milk, beginning with the feed and treatment of the cow to the finished product, butter. We have better knowledge of the composition of good butter and its relation to good milk. We are much better acquainted with the agencies causing the ripening of cream, the change it undergoes in ripening and the effect upon the quantity and quality of butter produced. Legislation, national and state, has undoubtedly done much to better the butter product, by heavily taxing imitation products, by enacting and enforcing laws regulating the sale of oleomargarine, by encouraging dairying in the establishment of dairy schools and dairy exhibits, by enforcing the selling of "patent butter," etc., by their proper names. Perhaps some further good might be accomplished in this line, as has been strongly contemplated in England, by fixing limits for the ingredients of the article selling under the name of butter. Our state and others have already done this for milk, cream and cheese. By no means an unimportant factor in the production of good butter is the increase of creameries, private and co-operative, admitting the employment of educated and experienced butter makers and the introduction of centrifugal separators. It is impossible now to estimate the value to the dairy industry of paying for milk according to its fat content.

Unquestionably the most prominent scientific investigation of late years in the dairy industry is in the field of bacteriology. Milk being a perfect culture medium for bacteria, there is found in it almost innumerable colonies of micro-organisms. While it is now conceded that milk, when drawn from the cow, care being taken to sterilize everything likely to come in contact with the milk and to exclude air, will not contain germs; yet ordinarily they are found in fresh milk and increase every minute until the milk enters the churn. Indeed, if it were not for certain of these bacteria it would be impossible to produce the fine flavor and aroma of good butter. A great many species of these bacteria, it may be mentioned, are not needed, and many which may enter through neglect are perhaps harmful or unhealthful, and certainly injure the flavor and keeping qualities of the butter. Prof. Storch has discovered the pure flavor producing bacteria. Cultures of such bacteria are now on the market for sale, so that by sterilizing "tainted milk" and adding the pure germs for a "starter" the finest butter may be obtained. It is even claimed that they are beneficial to uncontaminated milk by insuring predominance of flavoring bacteria.

The proximate composition of butter, as given by various authors, is as follows:

	Waller.	Average of many analyses.
Fat	83 to 85	83
Water	8 to 10	14
Curd	1 to 3	1.2
Ash	3 to 5	...

Vieth furnishes the following figures:

Description.	No. Analyzed.	Water.	Fat.	Curd.	Ash.
English, fresh and salt	72	18-14.4	83-90.5	.02-1.5	00-2.99
English, fresh and salt, average	72	11.5	86.8	.59	1.02
French, salt	108	11.6-15.5	82.8-86.6	1.3-1.8	1.3-2.5
Danish, salt	17	9.5-17.	78.-87.5	.9-2.4	1-.8
Danish, salt, average	17	13.4	83.4	1.3	1.9
Swedish, average	25	13.7	82.9	1.3	2.0

Of the 267 samples analyzed 94.4 per cent contained between 10 and 16 per cent of water, none below 7.0 per cent or above 18.

The latest figures showing average composition of butter are those of Richmond in "Analyst," March, 1893.

ENGLISH BUTTER GAVE—

	Limits.	Average.
Water	16.49 to 11.58	13.99
Fat	86.19 to 80.14	82.98
Curd	1.05 to .62	.89
Ash	3.93 to 1.16	2.14
Reichert Vollny No.	30.8 to 24.9	28.10

The "water" as usually obtained by evaporation at the temperature of boiling water consists of water and probably some volatile compounds in the butter other than water; however, this gain in weight of water is somewhat balanced by the gain in weight of solids due to oxidation of the fat.

The "fat" consists largely of the glycerides of the fatty acids, stearic, palmitic, myristic, oleic, butyric, capoic, caprylic and capric. Probably the fat instead of being simply glycerides of the fatty acids as $C_3 H_5 (C_{18} H_{35} O_2)_3$, tri-stearin, is a complex glyceride of two or more of them.

$$\text{e. g. } C_3 H_5 \begin{cases} C_4 H_7 O_2 \\ C_{16} H_{31} O_2 \\ C_{18} H_{33} O_2 \end{cases}$$

A combination of tri-butyrin, tri-palmitin and tri-olein.

The principal reason for believing that the glycerides are combined in this way is that when subjected to the action of solvents, as alcohol, they do not conduct themselves as would single glycerides.

Probably the most complete and correct examination of butter fat is the following, by Koefoed.

The butter examined gave a Reichert number of 15.1—fatty acids 91.5.

Oleic acid Acid of formula $C_5 H_{28} O_4$ Acid of formula $C_{29} H_{54} O_5$ (?)	34.0
Stearic acid	2.0
Palmitic acid	28.0
Myristic acid	22.0
Lauric acid	8.0
Capric acid	2.0
Caprylic acid	.5
Caproic acid	2.0
Butyric acid	1.5

The "curd" of butter consists of the solids not fat of milk, less the ash. Any organic antiseptic added to butter, also certain coloring agents would be represented in the "curd." Other abnormal organic constituents as starch and glucose would be calculated as curd. Ordinarily casein is the chief and almost the only constituent of curd; it is in the insoluble condition; albumen, lactose, lactic acid and fibrin are present in traces only. A good creamery butter will contain between .80 and 1.20 per cent of "curd." Usually the less curd present the better the keeping quality of the butter. Danish butter contains more "curd" than Irish, English, French or American.

The "ash" of butter consists of the inorganic portion of the milk incorporated in the butter with a variable proportion of common salt and other inorganic material added, as saltpeter, lead chromate, borax, etc., which may be used for purifying, coloring or preserving. The "ash" of fresh butter is usually less than one per cent, and in salt butter seldom over four per cent. The ash of normal butter consists of the phosphates, chlorides and carbonates of potash, soda, lime, magnesia and iron.

It is my opinion that a butter containing over 18.0 per cent of "water," 3.00 per cent of "curd" and 6 per cent of "ash," or less than 75.00 of "fat" should be considered adulterated.

Butter made in different countries differs somewhat in composition. This is due in part to the method of manipulation, but somewhat to inherent differences in constitution Thus Danish butter, on account of little washing and working, contains an unusually large amount of water and curd. Antipodal butter has a higher percentage of volatile soluble acids. In this country there is a great difference even in creamery butter, although that made from the same factory is usually quite constant in composition. Mention has been made of the influence of feed and period of lactation upon the quantity and quality of milk produced. These factors also affect the composition of milk and hence the butter made from the same. Thus cotton seed in its various forms noticeably decreases the amount of volatile soluble acids and increase the melting point of butter. Probably other foods also influence butter, but as yet little tentative work has been done in this line. As the period of lactation increases the volatile soluble acids decrease.

Consumers have been so long accustomed to ripened cream butter that they will tolerate no other kind; yet, there are a few people who prefer the taste of sweet cream butter, and it is placed, to a limited extent, upon the market. Ladd finds that there is a great loss in churning sweet cream, at the usual temperature, but by lowering the temperature to 50 to 54 degrees F, there was no greater loss than in the ripened cream. By lowering the temperature the quality was also improved. He finds less casein (curd) in sweet cream butter. Curtis, (Texas,) finds little difference in loss of fat or quality of butter when churned under the same conditions. Patrick finds the yield of butter from ripened cream usually larger than sweet; ripened cream churned quicker, contained less fat, more water and more casein. The loss of fat in churning, washing and working was less with the ripened cream. Sweet cream suffered less deterioration by keeping than ripened cream. A second trial in 1893 confirmed the above result, except that there appeared to be no regular difference in the pecentage in casein.

Sometimes butter of all grades, but principally the poorer dairy, becomes rancid and unfit for sale as food. The commission houses buy such butter, wash and treat with chemicals and purifying agents and perhaps antiseptics and, thus patched up, place it upon the market. This summer a butter containing saltpetre and glucose was examined. The saltpetre was used in washing, aiding the washing out of butyric acid, while the glucose was added to make the butter "draw" better. Neither were in sufficient quantity to be considered an adulteration or harmful. When butter cannot be made presentable in this way it is sometimes remelted, purified and churned again with milk. Borax and other antiseptics are often added to such butter. Such practices should be discontinued, not alone because the product is unpalatable, but it lends an edged argument to oleomargarine's advocates.

ADULTERATED BUTTER.

Adulterated butter may be divided into four classes:

1. Oleomargarine.

a Oleomargarine.
b Butterine.

2. Oleomargarine and butter.
3. Butter and lard or other animal or vegetable fat.
4. Patent butter.

Oleomargarine: Although all products manufactured in part from animal or vegetable fat other than butter fat, sold for butter or as a substitute for butter, are by the United States law classed as "oleomargarine," yet to the manufacturers oleomargarine is known as a product made exclusively from beef fat or beef fat and butter, while a product made from lard is called butterine.

"Oleo oil," the principal ingredient of oleomargarine, is prepared from tallow rendered at a low temperature, the major part of the stearin of which is removed by cold and pressure. This product, either churned with milk or butter and colored, gives the various grades of oleomargarine on the market: Jersey, Kansas Dairy, Elgin No. 1, etc. Cotton seed oil is added in considerable quantity in winter. Butterine is made in the same manner from hog fat.

It is claimed that oleomargarine is composed of the same ingredients as butter and that there is no ingredient in oleomargarine not found in butter and vice versa. The supporters of oleo have gone farther and claim that oleomargarine is not a substitute for butter, but an artificial reproduction thereof. I am not referring now to be exaggerated claims of the manufacturers but much more trustworthy authority. (See Babcock, J. F., Scientific American, Vol. XXX, No. 757). There is some foundation for the statement, enough to make it misleading, but not enough to make it right. Beef and hog fat consist almost entirely of stearin, palmitin and olein. Butter contains these ingredients, but also many others, as will be noticed from the composition of butter fat. Butter also contains 5 per cent. or more of soluble glycerides of the fatty acids, while oleomargarine is almost wholly destitute thereof. These glycerides influence the flavor of good butter and probably aid in digestion. Nor are the ingredients of oleomargarine and butter present in the same proportion. Butter contains but a very small amount of stearin, while oleo oil, although a portion of the stearin is extracted from the tallow and is made into candles, still contains a large percentage. Moreover, oleo oil is a mechanical mixture of the glycerides; butter, as before mentioned, is probably a chemical combination. of them These may be as different as the mixture of the gases, hydrogen and oxygen, and the chemical product of their union—water.

HEALTHFULNESS AND WHOLESOMENESS OF OLEOMARGARINE.

Upon this subject may be found a variety of opinions. Persons wishing to prove the unwholesomeness of oleomargarine can find able authorities to support their position, while many of the eminent agricultural chemists are arrayed upon the opposite side. Undoubtedly some of the opponents of "bull butter" have been more radical in their views than facts would warrant, as witness one of the former reports of the commission in which a microscopical examination of butterine was made: "Bacteria, protozoo and doubtful portions of worms were noticed;" some bacteria, doubtless identified by rings on their tails, were "intimately connected with the micro cocci of smallpox, erysipelas and diphtheria." On the other hand it seems strange that such an eminent chemist as Dr. A. W. Atwater would allow himself to give an affidavit of purity to an article, the manufacture of which he had viewed but once, and then when everything was prepared for his reception. Oleomargarine toiling for over-production may be much different from oleomargarine on dress parade. Pure oleomargarine, i. e., oleomargarine made from pure oleo oil and cotton seed oil cannot be unwholesome. Only in the possibility of employing diseased animals, or uncleanliness in manufacture may it become so. From beef fat there is little to fear from living organisms. Made from neutral oil there may be a possibility of its containing trichina. By far the greatest opportunity for introduction of extraneous, unwholesome and unhealthful material is in the method of manufacture.

The following from a very conservative report, in fact, the most favorable report I have noticed, shows that the popular impression of the unwholesomeness of oleomargarine is not entirely without foundation, and that the manufacturers must give better proof than they have yet been able or willing to give before the people will have entire confidence in their affinity to godliness. The report may be found in the third annual report of the Ohio Dairy and Food Commission.

> * * * After we had stopped a few minutes where the hogs are killed, and where the fat is stripped from the intestines, we went directly to the building in which the oleomargarine and butterine are made. We passed through several rooms, first through those in which the product is finished, and advancing through the large building so as to see the butter substitutes in every stage, from the finished product down to the raw fats, we finally reached the rooms in which the raw materials, the animal fats, undergo the first process, and are thrown into big hoppers to be chopped, or cut up, by machinery. The further we went along the higher we found the temperature, which, as was stated to me upon inquiry, was about 100° F. in the room in which the raw fats are first taken into manipulation. Although the heat was rather oppressive to my companion and myself—the employes stated that it was almost unbearable in the summer—we stayed long enough to watch the proceedings, and to examine several truck-loads of raw fats. A good many of them arrived during our presence. On one side we found the beef fat (tallow) from the kidneys and from the intestines, and were informed upon inquiry that it served for the manufacture of oleomargarine; on the other side we found leaf-lard (kidney fat) and the fat from the intestines (mesenterium and caul) of hogs. The leaf-lard of hogs and the kidney fat or tallow of cattle, arrived in separate cars or trucks, and looked clean enough, but the fats stripped from the intestines of cattle, as well as of hogs, but particularly of the latter, looked rather soiled as if they had been handled with very dirty hands, and in the cars or trucks, which contained the same, we saw here and there small slices of meat and parts of an intestine. One piece of intestine, apparently of the rectum, was at least two feet long. That the mesenterium contained the mesenteric glands, is self-evident. The fats of hogs, we were informed, are used for the manufacture of butterine; at any rate, we saw that they went into separate tanks, and were not mixed with the tallow of cattle. * * *
>
> DR. H. J. DETMERS,
> Professor of Veterinary Surgery, O. S. U.

It is now universally admitted that oleomargarine is less easily digested than butter and its co-efficient of digestion (i. e., relation of digestible portion to the total) has been found to be less than butter.

The oleomargarine upon the Minnesota markets I find to be colored yellow by an aniline dye, methyl orange or helianthin. Many of the aniline dyes are poisonous in themselves, but all are liable to contain poison, as arsenic is used in their manufacture. However, the small dose of poison taken in the butter coloring could hardly produce toxic effects.

Oleomargarine, were it not unwholesome, is at least a fraud as it is usually consumed for butter, and is a menace to our farmers and factories. If the bogus product should be colored pink, as required by law, there could be less room for objection. Surely this is reasonable, possible and plausible. Among aniline dyes there is eocene pink, the beautiful fast new pink "rhodamine," and probably many others. From the animal kingdom we get carmine which has been found applicable in coloring fats pink. Then there is a perfectly harmless dye from the vegetable kingdom which is a perfect coloring agent for oils and may be applied in the same manner as annotto.

What has been said regarding the manufacture, wholesomeness and coloring of oleo oil is true likewise of the better grade product containing usually about 12 1-2 per cent. of butter fat.

A few mixtures of butter and lard have been found on the market. Some of these were mixed by commission merchants and some by country makers. But very little of such product is on the market.

Patent butter is simply a butter containing an abnormal amount of water and perhaps somewhat larger proportion of curd than in normal butter. This "filling" with water is accomplished by the use of some digestive ferment as pepsin or rennet, (black pepsin) which emulsifies the fat, enabling it to take up an equal bulk of milk. During the summer a company was securing agencies in the twin cities for the "great California discovery" for increasing the yield of butter. None of such butter has been received in the laboratory.

The following table records the analysis of adulterated or illegal butter. All figures given by the chemist are recorded. Often a single determination will determine the fact of adulteration and sometimes the approximate amount of adulteration to the satisfaction of the chemst. But when such analysis must be presented to the court as evidence, as has been the case this summer, any one determination is unsatisfactory and the more complete the analysis the better your case.

ANALYSIS OF ADULTERATED OR ILLEGAL BUTTER.

NAME OF SELLER AND LOCATION.	Sold for.	Water.	Fat.	Casein, etc.	Ash.	Vol. Sol. Fatty A.	Reichert Vollny No.	Iodine Absorption.	Specific Gravity.	How Adulterated.
Chas. J. Johnson, St. Paul.	Butter	5.35	9.65	.97	3.03	.09	.51	....	....	Oleomargarine.
E. Constant, St. Paul	Butter	5.93	88.83	1.30	3.94	.08	.46	....	....	Oleomargarine.
Errikson Bros., St. Paul	Butter	7.76	83.37	1.88	7.00	3.41	19.4	....	....	Mixture.
Kranz & W., Duluth	Oleo	8.50	85.80	1.32	4.37	0.56	.32	....	....	Oleomargarine.
Cox Bros., Duluth	Butter	8.65	83.60	1.13	6.62	.12	.68	....	....	Oleomargarine.
J. Wilke, Duluth	Oleo	7.61	86.66	.77	4.96	.14	.84	....	....	Oleomargarine.
Mosher & Knittle, Duluth	Oleo	8.48	86.32	1.40	3.80	.10	.57	....	....	Oleomargarine.
J. Wilke, Duluth	Oleo	8.79	86.59	1.14	3.48	.07	.39	....	....	Oleomargarine.
W. J. Mears, Minneapolis	Butter	6.56	91.44	.50	1.50	.54	3.05	....	....	8 to 12 butter.
Owen Epply, Minneapolis	Oleo	9.17	89.31	.44	1.08	.51	2.9	....	....	8 to 10 butter.
W. Severly, Minneapolis	Oleo	9.95	86.69	.53	2.73	.53	3.	....	....	8 to 10 butter.
C. C. Miller, Minneapolis	Oleo	7.88	87.60	1.04	3.48	.06	.33	....	....	Oleomargarine.
C. Kennelly, Minneapolis	Oleo	7.69	89.66	.64	2.00	.04	.25	....	....	Oleomargarine.
J. N. Davis, Minneapolis	Oleo	7.35	90.09	1.18	1.34	.06	.37	.69	....	Oleomargarine.
John Nelson, Minneapolis	Oleo	9.55	86.05	.67	3.72	.06	.33	....	....	Oleomargarine.
Chas. Mattson, Minneapolis	Oleo	....	....	....	....	....	.06	....	....	Oleomargarine.
Sample No. 152, St. Paul	Butter	....	....	....	....	....	21.30	....	....	Lard & butter.
Sample No. 50, St. Paul	Butter	....	....	....	....	....	23.85	....	....	Lard & butter.
S. Clark & Co., St. Paul	Butter	....	....	....	....	....	.36	....	90.47	Oleomargarine.
J. Wilke, Duluth	Oleo	....	....	....	....	....	.26	55.	90.45	Oleo 12 5-10 but.
Minneapolis Provision Co.	Oleo	....	....	....	....	....	3.91	49.3	90.50	Oleomargarine.
Unknown	Oleo	....	....	....	....	....	.65	53.9	90.45	Oleomargarine.
H. Halasek, Herman	Butter	....	....	....	....	....	21.15	....	....	Foreign fat.
H. Halasek, Herman	Butter	....	....	....	....	....	21.15	29.3	91.03	Foreign fat.
H. Halasek, Herman	Butter	....	....	....	....	....	22.35	....	....	Foreign fat.
P. P. Pierce, unknown	Oleo	....	....	....	....	....	1.10	22.6	90.62	Oleomargarine.
H. Halasek, Herman	Butter	....	....	....	....	....	22.10	....	91.08	Foreign fat.
H. Niquette, Duluth	Oleo	....	....	....	....	....	.06	....	....	Oleomargarine.
C. C. Miller, Minneapolis	Oleo	....	....	....	....	....	.04	....	....	Oleomargarine.

ANALYSIS OF PREMIUM BUTTER AT THE WOLD'S FAIR.

The average water content of butter and the water content of butter considered the best by competent judges is always a matter of interest and value. The Danish and English have already taken steps to regulate the percentage of water and fat in butter. The Prussian minister of agriculture has lately requested the agricultural experiment stations to make extensive studies on the percentage of water in butter at different seasons of the year, with a view to fixing the maximum for the water content of butter. The percentage of salt and casein held in good butter should be the ideal to which the buttermaker should strive.

Through the courtesy of Mr. J. L. McKinstry of Minnesota, and Mr. G. L. Gabrielson of Iowa, samples of premium Columbian fair butter made in Minnesota and Iowa were procured. It was thought that the chemical composition of such butter might be of interest in the points already mentioned, and that possibly such analyses might throw more light upon the relation of chemical constitution to commercial quality of butter. If of no value in themselves, it is hoped that in conjunction with other and future analyses, some way may be found of judging the quality of butter by the chemical analysis.

As an aid in studying the results the following analyses of premium butter from other sources are recorded.

At the Connecticut experiment station 11 samples of private dairy and 6 samples of creamery butter were analyzed.

	CREAMERY.		PRIVATE DAIRY.	
	Range of Composition.	Average Composition.	Range of Composition.	Average Composition.
Water	6.5-11.4	9.1	8.6-12.7	10.8
Fat	84.3-88.4	86.9	80.7-87.7	83.9
Curd	.9- 1.6	1.1	.9- 2.5	1.5
Ash	2.1- 4.0	2.9	1.2- 7.8	3.8

The private dairy butter which received the lowest grading for flavor, grain and salt, were ones which had the very abnormal high per cents of salt (6.78 and 7.83).

The creamery butter, as a rule, carried three per cent more of actual butter fat than the private dairy.

The premium butter at the American Dairy show, held in Chicago in 1889, was analyzed with the following result:

No.	DESCRIPTION.	*Rat'g.	†Water.	Fat.	Curd.	‡Ash.
1	Sweepstakes, creamery, gathered cream	96.	9.99	85.41	1.01	3.58
2	Sweepstakes, creamery, whole milk	94.	12.19	82.66	1.21	3.93
3	Sweepstakes, dairy	93.	8.49	86.53	.86	4.12
4	Sweepstakes, butter from grade cow	95.5	9.71	85.96	1.03	3.29
5	First prize, butter from Jersey cow	91.	8.99	88.08	.79	3.13
6	First prize, butter from Shorthorn cow	91.	12.07	84.79	1.34	1.79
7	First prize, butter from Ayrshire cow	93.	9.53	86.53	.81	3.32
8	First prize, butter from Devon cow	87.	10.78	86.20	.72	2.29
9	First prize, butter from Holstein cow	92.5	10.56	85.53	.88	3.03
	Average	92.5	10.23	85.74	.96	3.05

* The standard of the scale of points in the total of 100 was: Flavor, 35; grain, 30; color, 15; salting, 10.

† The per cent. for water may be somewhat low, due to loss by evaporation while on exhibition.

‡ Chiefly salt.

The three butters showing the lowest rating in salting were also lowest in the total rating and contained the smallest amount of salt.

The following analysis represents the product of a separator factory, the butter sampled directly as made: Water, 14.12; fat, 80.63; curd, 1.20; ash, 4.05. Butter from this factory would, as a rule, not vary much from the representative analysis. It is recorded more especially on account of the unusually high percentage of water.

The samples of Columbian fair premium butter were received in the laboratory in tight stopped glass bottles. Some of the water had separated out, otherwise the samples were in good condition, fresh and good flavor.

The sample for analysis was prepared as recommended by the association of official agriculturist chemists (Bulletin 35,) and an homogeneous sample secured. The method of analysis was essentially that adopted by the A. of O. A. C. Each determination was made in duplicate.

ANALYSIS.

No.	Description.	Water.	Fat.	Curd.	In Sol. Ash.	Salt.	Sp. Grav.	Absorption cap. for Iodin.	Reichert Vollny No.
3138	Separator, 96 points	8.50	87.35	1.15	.10	2.89	.9999	....	26.20
3114	Gathered cream, Iowa, 94 p	9.05	87.77	.93	.10	2.14	.9100	37.4	25.45
2899	Gathered cream, Minnesota	11.68	84.04	1.05	.08	3.17	.9096	37.7	26.20
H	First Dairy, Minnesota	11.37	84.39	.81	.05	3.40	.9097	....	27.75
3141	Set Milk, Iowa	8.80	88.03	1.07	.08	2.26	.9098	37.7	27.75
	Average	9.88	86.11	1.00	.08	2.77	.9098	37.6	26.67

The two samples of butter from Minnesota are lower in fat and higher in water and ash than the samples from Iowa. There appears no consistent difference between the various kinds and grades of butter.

This conclusion is in line with Whitcher, who remarks that he finds that something more than a chemical analysis is required to determine the marketable quality of butter. So it must be concluded that, although unquestionably creamery butter is becoming more uniform in quality, the time has not yet arrived when we can distinguish by a chemical analysis the best grades of creamery and dairy butter. A chemical analysis of much of the butter on the market will give a fair index to the manner of manufacture.

In comparing the analyses of the premium butter in 1889 and 1893, it will be noticed that the agreement in percentage of water, fat, curd and salt is remarkably close. The salt is a trifle less, and this is singular, as even 3.00 per cent is less than usually found in the butter on the market. The salt of butter is as far as possible in solution in the water present, and in well-made butter should not exceed a saturated solution of salt in the water present. In old butter, from which water has evaporated, it may be noticed that salt crystalizes out, yet in a different form or mode (needles) from that usually exhibited (cubes). As the amount of fat in butter is almost entirely dependent on the water content the determination of water or total solids is the most valuable determination in the analysis of butter. Much, and it may almost be said, most of the butter produced will be found to contain over 10 per cent of water. 85 per cent of Danish export butter is said to contain between 13 and 16 per cent of water. The analysis of the premium Columbian Fair butter confirms the results heretofore obtained, that the best butter is not "adulterated" with water, indeed rarely exceeds 12 per cent.

The Riechert Vollny figure for volatile soluble acids is singularly low. It would certainly be desirable that this determination be made upon other high grade butter, as this determination is of much importance in detecting adulteration.

MINNESOTA STATE FULL CREAM CHEESE.

The tables of analyses heretofore published show that the standard of Minnesota full cream cheese has been fully maintained. Due largely to the efforts of Minnesota, Wisconsin and Iowa dairymen, there has been an increased demand for full cream cheese. Indeed, while but a few years ago it was thought that not only was the best made cheese from Holstein milk, but that it was impossible to manufacture cheese from rich milk without great loss of fat. Now it is possible to manufacture cheese from good and even "rich" milk with practically no loss of fat in the pressing or in the whey. The most complete and instructive work of late years in this line has been done by the Iowa experiment station; fifteen cheese were made from milk, varying in fat content from partially skimmed milk to milk to which cream was added. The milk, the first and second whey, the press drip and the resulting cheese were analyzed, and the loss in fat and albuminoids in manufacture determined.

The following is a condensed table of results:

TABLE No. II.

Showing the pounds of milk required to make one pound of cheese, the pounds of cheese made from one pound of fat, and the loss of fat, casein and albumen during the process of manufacture.

Number of Cheese.	Per cent fat in milk.	Pounds milk required to make one pound green cheese.	Pounds of cheese made from one pound of fat in milk.	Per cent fat in first whey.	Per cent lost of the original amount of fat in the milk.	Per cent of casein and albumen in the milk.	Per cent lost of oaiginal amount casein and albumen in the milk.
1	1.75	12.62	4.39	.15	7.7	3.72	19
2	2.49	11.16	3.59	.17	9.3	3.88	24
3	3.07	10.85	3.00	.17	4.9	4.05	23
4	3.58	10.06	2.77	.13	3.4	2.70	22
5	4.06	10.11	2.44	.34	7.6	3.00	25
6	4.07	9.80	2.50	.28	6.2	3.03	22
7	4.20	9.17	2.59	.26	6.2	3.93	20
8	4.61	8.60	2.52	.38	7.4	2.94	24
9	4.98	8.55	2.34	.63	11.6	2.85	24
10	5.10	7.86	2.49	.54	11.6	2.89	25
11	5.45	8 34	2.20	.45	7.2	2.84	26
12	6.18	7.43	2.17	.43	8.1	2.99	25
13	6.81	8.64	1.92	.66	13.4	2.80	24
14	6.83	7.13	2.04	.33	4.2	2.90	22
15	8.40	6.01	1.97	.65	7.4	3.00	23

Attention is particularly called to column No. 5.

It appears then that there is no definite relation between the fat content of the milk and the loss of fat in manufacture. This result has also been obtained in Minnesota and Vermont.

Other things being equal, a cheese containing a large percentage of fat is better because, first, of finer flavor and taste; second, of its better consistency; third, of its improved aroma; fourth, of its increased digestibility; fifth, of its more perfectly answering the requirements of a perfect single food (balanced ration).

As improved cheese is placed upon the market the people are educated into using cheese as a staple food to a much greater extent than formerly. The full cream cheese leads the van, while the skim is relegated to the rear.

DISCUSSION OF THE STATE STANDARD.

The table of analyses shows that Minnesota dairymen have kept much in advance of Minnesota law. Yet it is a matter of regret that cheese varying so greatly in composition and value should parade under the same label. Uniformity as well as quality must be considered in creating and maintaining the demand for a certain brand of cheese. While with no spur but their collective interest and individual reputation, the great majority of Minnesota dairymen have produced an excellent grade of cheese, yet a few have not only made cheese from very poor milk but from partially skimmed milk. In so doing they tend to drag down the reputation of the standard state brand. In fixing a standard for full cream cheese, it is necessary to show the relation of the milk from which the cheese is made to such standard.

Calculating from a milk containing 3.50 per cent fat, allowing 3.00 per cent for albuminoids (certainly low enough) calculating the ash in cheese at 18 per cent of the casein, curiously a fairly constant factor as shown by analyses; making allowance for the loss of fat and albuminoids occurring in the manufacture of properly made cheese, we get 51.9 per cent of fat to total solids. This figure may be a trifle high, due to the small and variable amount of lactic acid in cheese. As the abstraction of fat does not greatly change the composition of non-fatty solids, this milk skimmed to 2.00 per cent of fat, allowing for the losses already mentioned, could be manufactured into a cheese containing 40 per cent of fat to solids—the present state standard for Minnesota full cream cheese.

How do these calculated figures compare with the direct analysis of cheese? I have calculated the ratio of fat to solids in the experiment referred to above, using, however, the figure for total solids derived from the subtraction of the percentage of moisture from 100 per cent instead of that obtained by the addition of the various ingredients of the solids as found by analysis. If it were not for unrecognized or unknown components of the solids and errors of analysis these figures should be identical. The indirect figure for solids gives a percentage of fat to solids of .2 to 2 per cent less than that derived from the given figures for solids.

No.	Per cent of Fat in milk.	Per cent of Fat to solids in cheese.
1	1.75	37.3
2	2.49	43.8
3	3.07	49.0
4	3.58	53.0
5	4.05	55.1
6	4.07	55.3
7	4.20	58.2
8	4.61	59.8
9	4.98	62.5

It will be noticed that milk reduced by skimming to 1.75 per cent fat, or one-half of our legal standard for milk, can be manufactured into a cheese almost complying with our state standard for full cream cheese. No. 4, just within the standard for fat, makes a cheese containing 53.0 of fats to solids. Both closely agree with the calculated figures.

Referring to the work of the commission:

	M'p'l's dep't.	St. Paul dep't.
The average of all analysis in 1887-88	48.33	42.36
The average of all analysis in 1889-90	50.14	50.13
The average of all analysis in 1890-92	49.66	49.48
The average of all analysis in 1892-93	48.90	50.99
The average of all analysis in 1892-93	49.90	.....
The average of state fair cheese 1892-93	47.42	51.10

It should be remembered that these analyses include many cheese which were manufactured from partially skimmed milk but which the chemist must report as full cream. Cheese analyzed in the Minneapolis department ran uniformly lower in fat in samples than should have analyzed about the same. This can only be accounted for by difference in method of analysis.

Prof. Harry Snyder, of the Minnesota experiment station, found over 40 per cent of the total solids to be fat in cheese made from milk containing 2.75 and 2.80 per cent of fat respectively. In normal milk containing 3.50 per cent of fat he found over 50 per cent of the total solids to be fat.

It seems to me that our legal standard for "Minnesota full cream cheese" should be at least sufficiently high to correspond with our minimum percentage of fat as established by law. A ratio of 50.00 per cent of fat to solids, i. e., one-half of the total solids fat, would allow all cheese properly made from 3.50 per cent milk and better to be labelled and sold as "Minnesota State Full Cream Cheese." I am satisfied that if such a standard were adopted there would be a yet greater demand for Minnesota full cream cheese at home and abroad.

CHEESE. EBERMAN, Chemist.

No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.
1	53.65	43	50.77	85	51.01	127	50.52	169	51.55
2	51.83	44	49.52	86	53.58	128	48.22	170	50.84
3	51.66	45	50.08	87	51.76	129	50.27	171	48.27
4	50.14	46	51.69	88	51.30	130	50.59	172	50.60
5	51.00	47	51.62	89	51.25	131	50.27	173	48.67
6	50.00	48	51.50	90	52.89	132	48.72	174	47.85
7	50.42	49	52.14	91	52.21	133	47.12	175	51.51
8	49.22	50	51.97	92	52.13	134	47.74	176	47.55
9	50.90	51	51.42	93	52.15	135	49.16	177	52.49
10	51.08	52	48.82	94	49.59	136	51.61	178	47.76
11	53.80	53	52.35	95	50.47	137	52.42	179	48.52
12	49.16	54	52.36	96	51.04	138	49.37	180	51.78
13	48.92	55	54.72	97	50.28	139	50.27	181	49.86
14	48.91	56	47.11	98	51.75	140	47.75	182	53.61
15	51.76	57	53.24	99	51.27	141	52.65	183	49.37
16	52.46	58	53.17	100	51.25	142	55.16	184	52.51
17	48.19	59	51.67	101	50.89	143	54.84	185	54.42
18	44.80	60	46.50	102	51.16	144	50.42	186	50.00
19	50.00	61	52.51	103	51.31	145	55.64	187	48.47
20	48.25	62	51.50	104	51.65	146	54.98	188	51.92
21	47.42	63	50.95	105	51.67	147	58.07	189	52.70
22	52.53	64	51.34	106	50.96	148	52.03	190	47.00
23	51.54	65	50.73	107	52.05	149	43.94	191	47.48

CHEESE. EBERMAN, Chemist.—Continued.

No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.
24	51.52	66	55.00	108	50.42	150	50.72	192	48.37
25	50.27	67	52.02	109	51.59	151	51.94	193	49.42
26	48.15	68	51.45	110	52.19	152	52.73	194	47.43
27	52.26	69	56.37	111	52.16	153	53.28	195	53.84
28	48.19	70	52.95	112	51.01	154	51.76	196	48.12
29	50.90	71	52.01	113	50.49	155	53.55	197	50.64
30	52.66	72	52.46	114	51.61	156	52.38	198	49.62
31	49.29	73	50.58	115	51.84	157	48.51	199	48.44
32	52.60	74	47.00	116	53.96	158	51.71	200	52.95
33	50.91	75	51.63	117	51.03	159	53.64	201	49.36
34	50.72	76	51.74	118	52.03	160	54.29	202	50.55
35	51.55	77	52.38	119	52.64	161	53.54	203	49.65
36	51.22	78	54.00	120	51.79	162	54.95	204	50.96
37	48.62	79	51.87	121	49.36	163	50.00	205	51.28
38	50.75	80	53.05	122	49.42	164	51.57	206	50.03
39	51.71	81	53.12	123	51.44	165	43.97	207	50.33
40	50.88	82	53.90	124	51.19	166	51.63	208	50.21
41	50.77	83	52.64	125	49.62	167	51.60	209	50.71
42	49.79	84	50.21	126	50.30	168	53.14	210	50.00
Mean									50.99

CHEESE. DREW, Chemist.

No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.
2	45.69	48	47.23	94	50.16	139	51.45	184	50.93
3	48.40	49	46.87	95	43.85	140	48.56	185	50.27
4	48.21	50	48.69	96	48.00	141	47.69	186	49.79
5	47.64	51	48.85	97	48.59	142	47.47	187	48.71
6	47.19	52	47.49	98	48.74	143	48.54	188	51.01
7	49.03	53	46.56	99	49.36	144	49.19	189	50.49
8	45.84	54	50.44	100	47.06	145	46.81	190	50.50
9	49.21	55	50.98	101	46.19	146	47.97	191	52.73
10	41.77	56	51.52	102	44.44	147	49.44	192	54.36
11	49.52	57	49.43	103	52.32	148	51.41	193	51.29
12	48.33	58	50.43	104	42.16	149	50.20	194	51.10
13	45.79	59	50.43	105	47.38	150	48.46	195	50.49
14	44.79	60	51.13	106	53.22	151	48.39	196	51.22
15	48.68	61	50.32	107	49.16	152	46.92	197	51.00
16	49.21	62	49.00	108	48.24	153	48.24	198	50.93
17	47.92	63	47.46	109	49.56	154	52.77	199	50.95
18	48.67	64	47.35	110	49.15	155	52.82	200	49.49
19	48.61	65	47.07	111	49.73	156	52.27	201	49.67
20	50.77	66	48.37	112	49.25	157	52.03	202	49.15
21	51.26	67	47.06	113	49.49	158	51.58	203	51.41
22	50.31	68	44.46	114	50.73	159	51.10	204	48.64
23	50.66	69	44.89	115	48.97	160	51.29	205	49.32
24	50.77	70	45.78	116	46.94	161	48.58	206	47.58
25	51.65	71	44.51	117	47.60	162	49.20	207	47.60
26	50.27	72	47.64	118	47.41	163	48.82	208	46.81
27	46.13	73	44.61	119	49.34	164	49.15	209	50.89
28	46.43	74	46.46	120	48.15	165	50.09	210	49.57

CHEESE. DREW, Chemist.—Continued.

No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.	No.	Per Cent of Fat to Solids.
29	50.14	75	48.94	121	49.77	166	51.59	211	49.26
30	47.00	76	48.28	122	47.69	167	49.86	212	48.62
31	50.49	77	49.08	123	48.60	168	49.43	213	50.89
32	49.77	78	45.83	124	47.41	169	47.00	214	52.11
33	47.83	79	47.93	125	50.35	170	48.68	215	51.10
34	50.57	80	46.82	126	50.17	171	49.21	216	50.34
35	51.15	81	45.34	127	48.54	172	48.24	217	51.00
36	50.67	82	44.82	128	50.44	173	48.67	218	50.77
37	52.15	83	44.98	129	47.34	174	48.23	219	48.24
38	45.75	84	52.94	130	49.25	175	46.43	220	51.38
39	46.10	85	47.37	131	47.55	176	49.31	221	49.57
40	46.88	86	49.09	132	50.91	177	44.79	222	48.54
41	48.23	87	54.09	133	46.97	178	48.53	223	49.34
42	48.37	88	48.59	134	44.34	179	48.53	224	51.01
43	49.40	89	47.70	135	45.15	180	48.71	225	50.63
44	49.22	90	43.37	136	47.34	181	48.95	226	48.62
45	50.91	91	49.00	137	49.49	182	49.52	227	52.12
46	48.81	92	48.18	138	50.14	183	50.66	228	49.77
47	49.48	93	45.34						
Mean									48.90

ADULTERATED CHEESE.

Skimmed Cheese:

The fact that the state standard of fat in cheese is entirely too low, as shown in the previous article, accounts for the small number of skimmed cheese discovered. The inspection has been thorough and only those selected by the special cheese inspector as indicating deficiency in fat submitted to analysis. The condition of the market is even more free from illegally-branded cheese than stated in the last biennial report when it was placed as low as 3.27. Furthermore the lion's share of such cheese is manufactured in neighboring states.

Filled Cheese:

There has been discovered on sale in Minnesota another form of adulterated cheese more deceptive to the purchaser than skimmed cheese. This is the so-called filled cheese analogous in some respects to oleomargarine and butter substitutes. The term filled cheese is used to designate cheese made from milk from which a part or all of the fat has been taken and replaced by some cheaper fat.

In the early history of its manufacture beef fat was used. Then succeeded lard and cottonseed oil. Deodorized lard or oleo oil are used today. It is claimed that the lard of necessity must be the best quality (neutral oil) and thoroughly deodorized by steam under pressure, else the product is unpalatable.

The process used in New York State in 1881 is given by Caldwell, as follows:

"In this process an emulsion of lard is made by bringing together in a 'disintegrator' lard and skimmed milk, both previously heated to 140° Fahrenheit in steam jacketed tanks. The 'disintegrator' consists of a cylinder revolving within a cylindrical shell. The surface of the cylinder is covered with fine serrated projections, each one of which is a tooth with a sharp point. As this cylinder revolves rapidly within its shell, the mixture of melted lard and hot skimmed milk is forced up in the narrow interspace and the lard becomes very finely divided and most intimately mixed or 'emulsionized' with the milk. This emulsion consists of from two to three parts of milk to one of lard. It can be made at one factory and taken to another to be used for cheese, but it is usually run at once into the cheese vat. In making the cheese a quantity of this emulsion containing about 80 pounds of lard is added to about 6,000 pounds of skimmed milk and about 600 pounds of buttermilk in the cheese vat, and the lard that does not remain incorporated with the milk or curd, usually about 10 pounds, is carefully skimmed off. These quantities of the materials yield 500 to 600 pounds of cheese, containing about 70 pounds of lard, or about 14 per cent. About half of the fat removed in the skimming of the milk is replaced by lard (Munsell). According to many witnesses the imitation is excellent, for experts have been unable to pick out lard cheese from a lot of these and full-cream cheese of good quality together, and it may therefore be safely presumed that the general public would be unable to distinguish one from the other."

This process is now obsolete as indicated by the analysis of cheese recorded in the present report. By the above process only a part of the butter fat of the milk is replaced by lard, now it is entirely replaced as little or no butter fat is found in the filled cheese. Then the entire amount of fat was nearly equivalent to fat in cheese made from whole milk. Now the butter fat is not replaced by an equal weight of lard as the analysis shows less fat than found in full cream cheese. The latter practice is simply a corollary to the former, as lard produces a more oily texture and taste than an equivalent weight of butter fat. These changes in the ingredients of filled cheese were desired on account of the increased profit and made possible by the introduction of the "separator," and an improved process of emulsifying fat and skim milk. The separator skims milk as clean as could be desired. A number of devices have of late years been patented for emulsifying fat and skim milk. Among the best and most widely used is that of injecting a steam jet into a mixture of skim milk and lard or oleo oil.

As filled cheese is today manufactured its color, texture and taste —in brief, its physical properties—so resemble full cream cheese that even an expert cannot distinguish it from full cream or partially skimmed cheese. Of course, some factories not having the necessary facilities for properly emulsifying fat and skim milk make a peculiar mottled cheese easily distinguished from full cream. When a large amount of foreign fat is present it is liable to ooze out from a cut surface. If kept long, filled cheese acquires a very disagreeable rotten odor. These cheese are, however, the exceptions. To illustrate how perfect the deception,—out of 12 cheese sampled by the cheese inspector as being suspicious of foreign fat but one proved on a chemical examination to be filled.

The cheese found to be filled and reported in the advance sheets of this report led to a more extended investigation. It was then shown that not alone was ordinary cheddar cheese extensively imitated in this way, but fancy cheese for which fancy prices was obtained were not free from adulteration. Thus a so-called "brick cheese" handled by Morrison & Strowbridge of Minneapolis contained but a trace of butter fat. This cheese was light in color, possessed a high fat content (fifty per cent of fat to solids) and a decidedly strong and far from agreeable ordor.

CHEMICAL EXAMINATION OF CHEESE FOR FOREIGN FAT.

SAMPLING.

In most cases the sample for analysis was taken from unbroken cheese and as plugging in many places would interfere with its subsequent sale a smaller sample was in most cases obtained than the chemist desired. Usually three or four tryers full were obtained from different parts of the cheese, a portion being replaced to cover the holes. When obtained from retail stores a section as usually taken from centre to circumference was taken.

Representative portions of the sample were finely ground with a nutmeg grater and set aside to dry. In case the amount of fat was desired the sample was weighed.

DRYING AND EXTRACTION OF FAT.

After drying in the air on a warm radiator for two or three days the sample was mixed with about twice its weight of anhydrous copper sulphate by thoroughly grinding in a mortar. This mixture was transferred to a tube closed at one end with filter paper and linen cloth, as recommended by Short, and completely extracted with ether. Grinding and drying of the sample before mixing with anhydrous copper sulphate enables more than double the amount of fat to be obtained from extraction tubes of the same capacity; and was necessitated from the size of the sample and the apparatus at hand.

EXAMINATION OF FAT.

The Vol. Sol. acids in the dried fat were obtained by the glycerol method,—a modification of Reichert's Vollny's method, proposed by Leffmann and Beam.

Of the total number of cheese analyzed 518, 50, or 9.6 per cent, were adulterated; nineteen, or 3.6 per cent, of the total were found to be deficient in fat and thirty-one, or six per cent, filled. The filled cheese was largely shipped into this state from Chicago and much of it, if not most of it, manufactured in Wisconsin. Only one lot of filled cheese of Minnesota manufacture was found.

SKIMMED CHEESE.

Seller and Location.	Per cent of Fat to Solids.
Golden Rule, St. Paul	33.03
C. W. Clark, Owatonna	24.17
E. W. Pipen, Owatonna	11.84
C. M. Colby, Willmar	37.70
Kriske & Hemgahe	37.20
James R. Thompson, St. Paul	27.12
James R. Thompson, St. Paul	32.54
De Camp & Byer, St. Paul	35.6
Gamble, Robertson & Co., Minneapolis	18.02
Rich & Duett, Austin	24.
Malver & Henry, Albert Lea	9.
G. F. Radenbach, Austin	18.
Sumner Valley Factory, Haywood	30.4
Reiter Bros.	22.1
H. J. Meyer, Red Wing	2.08

FILLED CHEESE.

Seller and Location.	Per Cent of Fat to Solids.	Leffmann-Beam.
Lindal & Allen, Wisconsin	53.60	19.5
Holt Bros	34.85	3.
Lucas Bros., St. Paul	49.99	6.2
Morrison & Strobridge, Minneapolis	33.8	2.8
Ginter & Co., Minneapolis	45.2	17.7
Stewart & Elliott, Minneapolis	49.6	3.7
Golden Rule, St. Paul	30.9	3.2
A. Schoch Gro. Co., St. Paul	.....	1.8
Morrison & Strobridge, Minneapolis	.....	2.1
Potter Produce Co., Minneapolis	41.9	3.6
Allen, Moon & Co., St. Paul	51.1	1.
Herman Schroeder, St. Paul	47.	1.9
Herman Schroeder, St. Paul	.....	1.3
C. S. Gordon, Owatonna	44.2	2.
Walter & Harvey, Duluth	43.	1.7
G. H. Rever, Duluth	.8	.....
Walter & Harvey, Duluth	.....	1.3
W. H. Carpenter & Co., Duluth	.....	2.
Arundel, Warren & Co., Duluth	.....	1.
Fitsimmons & Dearing, Duluth	37.4	6.
T. A. Peirce, Rochester	.....	4.
A. O. Warner & Co., Red Wing	.....	2.5
C. E. Fredrich & Co., Red Wing	36.2	2.8
H. J. Meyer, Red Wing	.....	3.6
J. O. Hollen & Co., Stillwater	41.7	3.2
J. M. Schaffer, Stillwater	40.5	3.
C. C. Aldrich, St. Paul	.....	3.5
Schiermann & Co., St. Paul	.....	1.3
Ransom Bros. & Co. (special), Albert Lea	41.2	2.5
Theod. Trevillion, Duluth	.....	1.7

TECHNICAL DISCUSSION OF THE METHODS AND RESULTS.

As the examination of cheese for foreign fat is comparatively recent and but very little tentative work has been done, I append a table of analyses of cheese which were classified as cheese made without the addition of foreign fat. To my knowledge no results have been recorded with the "glycerol" method combined with Short's method of extraction of fat. The work heretofore recorded has been with the direct extraction of fat with ether or petroleum ether (which of necessity is incomplete) and the fat examined by the Reichert method. It may be well to state that even with the precautions taken to use as large sample as the apparatus or the samples secured would admit and to thoroughly extract the fat in the case of skimmed cheese it was necessary to operate on less than one-half charge, or 2.5 grams fat. In one case a cheese was found to contain as little as 2 per cent of fat in the water free substance, and in another, 1.8 per cent. Both were probably from the same factory and branded "Blue Grass Cream Cheese." In such sample and others in which but a small amount of fat was obtainable, one-half of each reagent used in the determination was employed.

No.	Kind of Cheese.	Glycerol No.	Remarks.
1	Full Cream	19.5	
2	Skim	24.0	
3	Skim	17.0	
4	Skim	28.5	Very small sample.

No.	Kind of Cheese.	Glycerol No.	Remarks.
5	Skim	25.0	
6	Skim	33.3	Very small sample.
7	Skim	26.5	
8	Full Cream	24.6	
9	Skim	25.4	
10	Full Cream	26.3	
11	Full Cream	26.3	
12	Full Cream	22.6	
13	Full Cream	25.5	
14	Full Cream	26.2	
15	Full Cream	25.4	
16	Full Cream	23.4	
17	Full Cream	20.0	
18	Skim	29.3	One-half Charge.
19	Skim	22.3	
20	Skim	23.5	
21	Full Cream	22.5	
22	Brick	23.9	
23	Full Cream	26.5	Reichert Vollny.

It will be noticed that the Vol. Sol. acids as expressed by the number of C. c. of N_{10} N_a OH required to neutralize the distillate on 5 grains of fat are lower than commonly met with in the analysis of butter. This is due, I believe, rather to the method of saponification than to the method of extraction, or any change in the fat after incorporation in the cheese. In my hands the Leffmann-Beam method has given uniformly lower results than the Reichert-Vollny, even with butter which from its physical properties appeared fresh. The following comparison of the two methods on butter apparently fresh,—those marked with an asterisk premium butter at the World's Fair,—show the tendency of the glycerol method to give low results:

	Reichert Vollny.	Glycerol.
Oleomargarine	.24	.32
Oleomargarine	.42	.68
Oleomargarine	.57	.57
Butter*	26.20	22.45
Butter*	27.75	23.60
Butter*	26.20	21.65
Butter*	25.45	23.30
Butter	30.20	27.65
Butter	28.60	25.20
Butter	25.50	25.1
Butter	26.9	24.8

I am aware that certain English analysts claim to get higher results with the Glycerol than with the Reichert-Vollny method, but such is not the experience of analysts in this country. (See Bulletin 22, U. S. Department of Agriculture.) Nevertheless I regard the method for the purpose of detecting adulteration superior to all other methods, as its results are strictly concordant among themselves and the method free from some of the faults of the Reichert-Vollny. The lowest limit for butter, if it is wise to have limits, must be lowered to 20 c. c. and adulteration certified to only when backed by good confirmatory evidence.

LARD.

The trial of Fowler Bros. of Chicago for selling as prime steam lard an article which did not meet the requirements of prime steam lard as defined by the Chicago board of trade, and the subsequent extended investigation of lard by the U. S. Department of Agriculture, awakened interest in the subject of lard adulteration, and called attention to the fact that a gigantic fraud existed in the manufacture and sale of pure refined lard; a fraud that whatever its relation to physiological economy was rapidly filling the coffers of manufacturing multi-millionaires and destructive to a large agricultural interest. Although the market at that time seemed laden with adulterated lard, sold unblushingly as purified leaf lard, the liberal expose through newspapers and other channels, state legislation prohibiting the sale of lard substitutes as lard, and perhaps to some extent the sale of lard substitutes and surrogates under their trademark names as a superior article, have all lessened to some extent the wholesale adulteration of lard. Yet an examination of the table of analyses will show that the market is by no means in as good condition as might be desired.

Correctly speaking lard is the fatty tissue of the hog separated from the other tissue by the aid of heat. At one time only the leaf fat was utilized for lard, but now almost all portions are used, either mixed together or rendered separately to make different grades of lard.

The grades of lard as recognized by the Chicago board of trade are as follows:

1. Neutral lard—Rendered in a kettle from leaf at 40 to 50 degrees C., acidity less than .25 per cent. Used in the manufacture of oleomargarine and filled cheese.
2. Leaf lard—Rendered from whole leaf or the leaf fat left in the rendering of neutral lard, by subjecting to steam heat under pressure.
3. Choice kettle-rendered lard—Rendered from leaf and back fat by steam in open vessels.
4. Prime steam lard—Practically the whole of the fat of the hog, except in some cases the leaf which may be used to make the better grades, subjected to direct steam heat.

Besides the brands of factory-made lard, there is the so-called home made lard, tried out from all edible fat over the kitchen fire; and butchers' ard, prepared as above and often from scraps that have been saved up for a considerable time before rendering.

LARD SURROGATES AND SUBSTITUTES.

The substances used to mix with lard or entirely take the place of lard are, beef fat or beef stearin, lard stearin, cottonseed stearin, cottonseed or other vegetable oil. Sometimes one of these products is alone mixed with lard. As but a small amount of adulterant can be used in this way the large manufacturers usually use cottonseed oil combined with some kind of stearin in the proportion to form a material of the consistency of lard. In this way the substitute or adulterant may be mixed with lard or sold as lard compound without admixture.

Anything not made of hog fat and used in place of lard is a lard substitute. If such article is labeled in such a manner as to convey the idea that the article is pure lard it may be said to be adulterated. In the first class come Cottolene, Vegetole, Cotto Suet, Cookene, etc., made without the addition of lard, or very little, if any. Thev are invariably sold under their patented names, are dark in color and could not be mistaken for lard. In the other class we have the same kind of substances with usually the addition of more or less lard, sold under the delusive names of "pure refined lard," "choice family lard," etc.

Chemically speaking, the various adulterants of lard, as well as lard itself, are mixtures of three fatty ethers, stearin, palmatin and olein. Stearin is a solid at and below usual summer temperature. Palmatin is solid in winter, but fluid in summer. Olein is a liquid, i. e., an oil even at winter temperature. In beef fat the stearin largely predominates. In lard the three glycerides are more nearly equal. In cottonseed oil, olein is much in excess. It is possible to mix beef fat with cottonseed oil in such proportion that the physical and chemical properties will not be sensibly different from pure lard. Only when the fats have not been mixed scientifically is there opportunity of detecting adulteration by purely chemical means. Fortunately there are certain uniform impurities of some of the oils and characteristic forms of chrystalization of the fats that will usually lead to their detection even when mixed in ideal proportion.

It is not the intention to discuss these tests in detail, but simply to call attention to them that the chemical data of the tables may be better understood.

In cottonseed oil there exists a substance, probably an aldehyde, not removed by ordinary purification which has the property of reducing a solution of silver nitrate to metalic silver. This test will readily detect 10 per cent and in some cases as little as 5 per cent of C. S. O. in lard. While the evidence of this test, if a marked reduction is shown, may be conclusive of adulteration the absence of such test is by no means decisive proof that the lard is above suspicion. The chemists employed by manufacturers have of late discovered a new way of refining C. S. O. so that the lard even when mixed with a notable proportion of C. S. O. will not respond to the silver nitrate test. Impurities in the C. S. O. also give color reactions with sulphuric and nitric acid.

Beef stearin has some properties different from stearin derived from other sources. If pure lard is dissolved in ether and left to slowly crystalize in a cool-place the crystals formed will be in the shape of oblique prisms of little thickness and with so small difference in refraction power from glass as to be with difficulty made out under the microscope. Under certain conditions the crystals are grouped in tufts radiating from a common centre. Beef fat in contradistinction crystalizes in straight or slightly curved filaform spicules or needles with pointed ends, usually grouped in bundles resembling a sheaf of wheat.

When observing a mixture of the two fats the distinction is not so obvious. In such cases the crystals are often obliquely terminated, yet grouped in beef bundles. Mutton fat under some conditions of crystalization resembles lard, only the crystals are much smaller and usually not arranged in tufts or bundles. Under different conditions the crystals resemble beef bundles. Beef stearin crystalizes from solution at a lower temperature than lard stearin. In practice both come down together much as alcohol, although having a much lower boiling point than water, cannot be entirely separated from water even by fractional distillation.

The amount of absorption capacity of the oil for iodine may be of value if the oils are imperfectly mixed. The absorption capacity of pure lard for iodine should not vary much from 60 per cent. If desired the percentage of olein may be calculated from this figure.

Ether Washed Deposit:

This method, based upon the crystallization of beef stearin in ether at low temperatures, was elaborated by W. F. Keating Stock, and read by him before the English Society of Public Analysts in January, 1894. The results, if all conditions are noted and the process carried out substantially as the author advises, are to a degree quantitative. In my experience it is the best method of quantitatively estimating beef stearin in lard yet discovered, and the surest method of detecting adulteration when but a small per cent, as from 5 to 7 per cent, of beef fat is present.

REPORT OF INSPECTION ON ANALYSIS OF LARD.

It would appear that up to the period covered by the present report very little adulterated lard was sold in Minnesota markets. During the latter part of '92 and first few months of '93 of a large number of samples analyzed but two were reported adulterated, as recorded in the table of results. Yet in March of the same year considerable of the adulterated goods were found parading under the name of lard. A systematic inspection of retail stores was made, resulting in disclosing the fact that much of the lard consumed in the state is of local manufacture and that much of the butchers' lard is adulterated with beef stearin. Particular attention has been given to collection of samples for analysis, of such brands of lard as a previous analysis proved to be adulterated. Hence the large number of adulterated samples reported. The market is not in as poor condition as the number of adulterated samples indicate, still there is large room for improvement. The analysis of the adulterated brands give the department all the advantage of the legal acts in preventing adulteration, shows the dealer that he cannot safely run the risk of detection, and shows him what brands are liable to be adulterated from their past record, and what business firms, wholesale and retail, make it a point to deceive their customers in the quality of goods they are buying.

Of the samples of lard examined by myself 37 were of local manufacture and 61 of foreign manufacture. Of the local manufacture there were pure, 27; compound, none; beef fat added, 9; water, 1; total, 37. Of those of foreign manufacture there were pure, 32; compound, 20; beef fat added, 5; water added, 4; total, 61. Of the total samples analyzed and sold as lard there were pure, 59, or 59 per cent; compound, 20, or 20 per cent; beef fat added, 14, or 14 per cent; water added, 5, or 5 per cent; total, 98.

Eleven samples of lard substitutes were examined, including all the trade-mark articles, I think, on the market. A comparative analysis of cottolene, vegetole and cotto suet is given at the bottom of the table of analyses. The analysis shows no great difference between them. In the sample of vegetole analyzed, however, the crystalization showed unmistakable evidence of lard. Lard stearin, either in the form of stearin, as is more probable, or combined as lard, was added to this particular sample. It is of course impossible, or at any rate unjust, to draw general conclusions from so few analyses.

Manufacturer.	Dealer and Location.	Sold as
Pioneer Packing Co	Edw'd Nelson, Minneapolis	Lard
G. H. Hammond	G. G. Blethen, Minneapolis	Lard
Unknown	John Brady, Moorhead	Lard
Local	A. Sturn, Crookston	Lard
Griggs, Cooper & Co	J. A. McConkey, Fergus Falls	Lard
Armour Packing Co	N. P. Ward, Alexandria	Lard
Geo. R. Newall	Carlson & Dahl, Minneapolis	Lard
G. H. Hammond & Co	P. O. Hammond, Minneapolis	Lard
G. H. Hammond & Co	J. A. Johnson, Minneapolis	Lard
G. H. Hammond & Co	J. A. Johnson, Minneapolis	Cookine
Pioneer Packing Co	John Foos, Minneapolis	Lard
Pioneer Packing Co	R. C. Pitcher, Minneapolis	Lard
G. H. Hammond & Co	Lucks Mercantile Co., Minneapolis	Cookine
Cudahy Packing Co	K. Olson, Minneapolis	Rexaline
Pioneer Packing Co	O. C. Thorp, Minneapolis	
Swift & Co	O. C. Thorp, Minneapolis	Cotto suet
G. H. Hammond	J. C. Higgins, Minneapolis	Lard
G. H. Hammond	M. Pay, Minneapolis	Lard
Local	F. M. Benson, Minneapolis	Lard
Local	John Carter, Minneapolis	Lard
Local	P. M. Anderson, Minneapolis	Lard
Cudahy Packing Co	Moss & Jackson, Minneapolis	Lard
G. H. Hammond	Lungrum & Bird, Minnapolis	Lard
Local	Byers & Co., Minneapolis	Lard
Hoyt	Luten Bros., Dexter	Lard
Pioneer Packing Co	W. Kuraszkiewicz & Co., Minneap'lis	
Cassiday Packing Co	North-West Grocery Co., St. Paul	
Nelson Morris & Co	Lund & Hardy, St. Paul	
Pioneer Packing Co	B. Bronstein, St. Paul	
Cudahy Packing Co	O. W. Brown, Minneapolis	Lard
N. F. Fairbanks	Mills Bros. & Hansen, Morris	Lard
Cudahy Packing Co	A. Stringer, Minneapolis	Lard
Cudahy Packing Co	F. J. Holmquen, Minneapolis	Lard
Cudahy Packing Co	Frank Fink, Minneapolis	Lard
Unknown	Theo. Vergman, St. Paul	Lard
Rendered in Laboratory	——— ———, St. Paul	Mutton tal'w
Local	Sample No. 1,000, Minneapolis	Lard
Local, sample 1,012	John Webber, Minneapolis	Lard
J. O'Leary & Son	Johnson & Co	
Armour Packing Co	T. Tailson, Minneapolis	Lard
J. O'Leary & Son	Grath & Son, Minneapolis	Lard
Minneapolis Stock Yd. Co.	H. H. Ockney, Minneapolis	Lard
Sample No. 1,031	Sulger & Farrer, Minneapolis	Lard
Twin City Packing Co	J. Ettel, Minneapolis	Lard
J. O'Leary & Son	Fellows & Metcalf, Minneapolis	Lard
J. C. Johnson & Co	Foreburg & Schusten, Minneapolis	Lard
Minneapolis Stock T. Co.	Londserh & Russeth, Minneapolis	Lard
Swift & Co	Unknown, St. Paul	Cottolene
Armour Packing Co	Unknown, St. Paul	Vegetole.
N. Fairbanks & Co	Unknown	Cotto suet

Water.	Ether washed deposit.	Calculated beef fat.	Bechi Reaction.	Absorp. cap. for Iodine.	Microscopic Indications.	Melting point.	Found to be
....	169.2	21. %	Med. heavy reduction	64.9	Beef fat	41.	Comp. lard
....	127.7	16. %	Marked reduction	65.	Beef fat	37.	Comp. lard
....	....	....	Marked reduction	....	Indicate beef.	....	Comp. lard
....	....	....	....	....	Indicate beef.	....	Lard & b'f fat
....	....	....	No reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	Marked reduction	....	Beef fat	....	Comp. lard
Yes	....	....	No reduction	....	....	....	Lard & Water
....	....	9. %	Med. heavy reduction	60.8	Beef fat	38.	Comp. lard
....	....	....	Med. heavy reduction	....	....	....	Comp. lard
....	....	....	Med. heavy reduction	....	....	....	Lard subs'tute
....	....	....	Med. heavy reduction	....	....	....	Comp. lard
....	....	....	Med. heavy reduction	....	....	....	Comp. lard
....	72.	....	Med. heavy reduction	....	....	....	Lard subs'tute
....	....	....	Med. heavy reduction	....	....	....	Comp. lard
....	....	....	Med. heavy reduction	....	....	....	Comp. lard
....	....	....	Med. heavy reduction	....	....	....	Lard subs'tute
....	....	....	Med. heavy reduction	....	....	....	Comp. lard
....	....	....	Slight reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	No reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	No reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	No reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	Marked reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	Slight reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	Slight reduction	....	Lard	....	Lard & water
....	....	....	Slight reduction	....	Beef fat	....	Lard & b'f fat
....	....	....	Marked reduction	....	Beef fat	....	Comp. lard
....	....	....	Marked reduction	....	Beef fat	....	Comp. lard
....	....	....	Marked reduction	....	Beef fat	....	Comp. lard
....	....	....	Marked reduction	....	Lard	....	Comp. lard
....	....	....	Very free reduction	72.4	B'f & l'd St.	....	Lard & b'f fat
....	....	....	Very free reduction	....	....	....	L'd & Cot'ns'd oil
....	....	....	Very free reduction	50.6	Beef fat	....	Comp. lard
....	....	....	Very free reduction	58.	Beef fat	....	Comp. lard
....	....	....	Very free reduction	58.9	Beef fat	....	Comp. lard
....	....	....	No marked reduction	....	Beef fat	....	B'f fat & lard
....	....	....	....	36.2	Mutton fat	....	....
....	....	....	....	64.5	Lard	....	....
....	....	....	....	56.9	Beef fat	....	B'f fat & lard
6.80	....	....	Slight reduction	57.5	Lard fat	....	Lard & water
8.00	....	....	Slight color	59.3	....	....	Lard & water
6.38	....	....	Med. heavy reduction	58.7	Doubtful	....	Lard & water
....	....	....	Very slight reduction	64.1	....	....	....
.25	....	....	Slight reduction	65.	....	....	Lard & water
....	....	....	....	54.9	....	....	B'f fat & lard
6.85	....	....	Very slight reduction	58.	Beef fat	....	B'f fat & water
6.84	....	....	Very slight reduction	61.3	....	....	B'f fat & water
....	....	....	Very heavy reduction	62.	Beef fat	....	Comp. lard
....	118.	15. %	Med. heavy reduction	87.8	Beef fat	46.1	Lard subs'tute
....	164.	20.5%	Marked reduction	92.	Lard	....	Lard subs'tute
....	....	....	Marked reduction	88.4	Beef fat	....	Lard subs'tute

VINEGAR.

The attention from the commission which this article has received seems at first blush in inverse ratio to its commercial importance, used as it is largely as a condiment and selling as low as 6 to 20 cents a gallon. Yet it is true that many thousand dollars are annually invested in its production in this state, and that home manufacturers cannot or do not nearly supply home consumption. Nor is there any article of food, with the exception of spices and extracted honey, adulterated more largely than vinegar. Such has also been the past experience of the officers of this department.

Chemically considered, vinegar is a dilute solution of acetic acid in water, containing also small amounts of other substances used in its manufacture or derived from fermentation. As an article of trade, as defined by English law, vinegar is an acid liquid produced by the alcoholic and acetous fermentation of a vegetable juice or infusion. Originally vinegar, as would be indicated from the derivation of its name, "*Vinaigre*," sour wine, was exclusively a product obtained by the fermantation of wine, now as is well known, the term has a much broader application and can only be specifically defined when a prefix designating its origin is used.

Even within the last few years there have been essential changes in the technology of vinegar manufacture. The starch of grain is converted into sugar using much less malted grain than formerly, and in some cases without the use of diastase. The old process of quiescent fermentation has given place to the quick process of generator oxidation. Except by the smaller and local manufacturers the quick process is the only one used even in cider vinegar manufacture. The only virtue in the quick process is in saving of time, as the quality of the product is rather depreciated than improved.

TECHNOLOGY OF VINEGAR MANUFACTURE.

While intended in no sense as a manual of vinegar making a brief description is given of the methods in use of converting grain into vinegar as usually practiced by the best vinegar makers. A more complete description can be had rather from the actual practice of the manufacturers than works in vinegar technology.

To produce acetic acid it is necessary to first obtain alcohol. Alcohol is not found free in nature but must be obtained from other sources, easiest and cheapest by the fermentation of sugar. Although sugar is found in many vegetables, it is chiefly sucrose or cane sugar, which is more expensive and does not answer the purpose as well as glucose sugars. These sugars, chiefly dextrose and maltose, can be best obtained by hydrolosis of starch, one of the most abundant products of the vegetable world. The use to which the sugars are to be put govern the method of accomplishing the hydrolosis. In this country for the production of alcohol and acetic acid the change is produced by a nitrogenized soluble ferment diastase. This ferment is best obtained by the germination of barley.

But as the diastase formed is much more than sufficient to convert the starch of the barley into sugar, corn or other grain is added in sufficient quantity to utilize all the diastase. A frequent formula in vinegar manufacture is 2,000 pounds corn, 150 of malt—germinated and dried barley—and 150 pounds rye. This mixture is heated with water in mash tubs for three hours at about 140 degrees F. The starch is by this process converted into maltose, a true sugar, and dextrin. This may be represented by the formula

$$\underset{\text{Starch}}{3C_6H_{10}O_5}+\underset{\text{Water}}{H_2O}=\underset{\text{Maltose}}{C_{12}H_{22}O_{11}}+\underset{\text{Dextrin}}{C_6H_{10}O_5}$$

It is stated by O. Sullivan that no dextrose or glucose proper exists in the malted grain at this stage. Besides the sugars mentioned there remains in the mash the small amount of sugar normal to the grain. Other changes take place at the same time caused by another soluble ferment formed during the process of fermentation; the so-called "peptose," which changes the proteids of the malt into peptones and perapeptones.

Although the hydrolosis of starch is usually accomplished by diastase, mineral and organic acids are sometimes employed as in the manufacture of glucose. Rice offers many advantages as a grain in this method of obtaining sugar.

The next step in the process is the conversion of sugar into alcohol. This is accomplished through the agency of an organized insoluble vegetable ferment—the yeast plant, *torula cerevisiae.*

There are a number of varieties of the yeast plant, some beneficial, some harmful. The wild yeast plant found floating in the air is not as advantageous to use as the cultivated variety.

The yeast works only under favorable conditions. These are, first, the presence of nitrogenous organic material; second, a solution containing not over one-fourth part of sugar and one-fifth part alcohol; third, a temperature between 33 degrees and 122 degrees F. Air is not essential.

The changes occurring are somewhat complex. The maltose is changed first into dextrose and finally into alcohol. The changes are represented in chemical language as follows:

$$\underset{\text{Maltrose}}{C_{12}H_{22}O_{11}}+H_2O=\underset{\text{Dextrose}}{2C_6H_{12}O_6}$$

$$\underset{\text{Dextrin}}{C_6H_{10}O_5}+H_2O=\underset{\text{Dextrose}}{C_6H_{12}O_6}$$

$$C_6H_{12}O_6+\text{ferment}=\underset{\text{Alchohol}}{2C_2H_5OH}+\underset{\text{Carbonic Acid Gas}}{2CO_2}$$

Ordinary alcohol or ethyl alcohol is not the only alcohol found. Butyric, propylic and amylic alcohol (fusel oil) are also produced. Secondary products are also formed. A small part of the sugar is by the influence of the ferment changed into succinic acid and glycerine. This change may be represented in chemical terms as follows:

$$\underset{\text{Dextrose}}{49C_6H_{12}O_6}+30H_2O=\underset{\text{Succinic Acid}}{12C_4H_6O_4}+\underset{\text{Glycerine}}{72C_3H_8O_3}+30CO_2$$

In wine making the secondary products are formed in considerable proportion, and usually in all alcoholic fermentation at least 95 per cent of the sugar is decomposed according to the main reaction. Volatile acids are also formed during this process, under favorable conditions in no small proportion. Thus, sugar is changed into lactic acid (the acid of sour milk) which is in turn converted into butyric, ($C_4H_8O_2$), caproic, ($C_6H_{12}O_2$), caprylic, ($C_8H_{16}O_2$), and œnanthic ($C_7H_{14}O_2$ largely) acids.

The change is represented as follows.

$$\underset{\text{Dextrose}}{C_6H_{12}O_6}=\underset{\text{Lactic Acid}}{2C_3H_6O_3}$$

$$\underset{\text{Lactic Acid}}{2C_3H_6O_3}=\underset{\text{Butyric Acid}}{C_4H_8O_2}+2CO_2+\underset{\text{Hydrogen}}{4H}$$

This change is important, as by action of alcohol upon these acids volatile ethers are formed which give the agreeable "boquet" to liquors and vinegar. The only essential outside of the material for their formation is time. Thus the "ageing" of wines, liquors and vinegar. As the acids necessary to the formation of aromatic ethers are volatile this reaction takes place also in distilled or low wine vinegar and much improves the flavor of the product. The change may be represented in part by the following equation expressed structurally:

$$\underset{\text{Acetic Acid}}{CH_2COOH}+\underset{\text{Alcohol}}{C_2H_5OH}=\underset{\text{Acetic Ether}}{CH_3COOC_2H_5}+\underset{\text{Water}}{H_2O}$$

$$C_3H_7COOH+C_2H_5OH=C_3H_7COOCH_3+H_2O$$

The alcoholic fermentation usually requires two to three days under favorable conditions.

DISTILLATION.

The alcohol must now be separated from the other organic constituents. This is done in a fair state of purity by distillation. By this means the alcohol is obtained mixed wth water and other volatile constituents of the wort. The alcohol obtained from the first distillation is called low wine. Hence the proper term, low wine vinegar, is applied to uncolored vinegar obtained by acetification of this product. For the purpose of vinegar making the strength of the alcoholic solution should not exceed 20 per cent. Otherwise the revenue tax must be paid as per government regulations. In practice the manufacturers do not care to distill any more water than necessary to recover all the alcohol, so the strength of the distillate usually runs from 18 to 20 per cent. It is the custom of most makers to dilute to 10 per cent before acetifying.

ACETIFICATION.

The next step in the process is the conversion of alcohol into acetic acid. This important work is always accomplished in water solution by the agency of microbes. Not until 1886 was it positively proven that the production of acetic acid was alone due to the activity of these minute forms of life. The specie producing this change formally termed *mycoderma aceti*, probably better named *bacterium aceti* (see Griffith's *micro organisms*) forms acetic acid as one of the bi-products of its life. Paradoxal as it appears, alcohol, the excreta of one microbe and the sole food of another, is fatally poisonous to both unless copiously diluted with water. It is now thought that there are two or more species concerned in the production of acetic acid; one a micrococci, in contiguous rows, and one a bacilli, in rod-like forms. They exist in the air at all times and are ready for work in a favorable climate and media. The conditions essential to their development and activity are:

1st. A dilute alcoholic solution not more than 12 per cent alcohol by weight.

2d. The presence of nitrogenous substances or proteids.

3d. The presence of phosphates of potassium, magnesium and lime.

4th. Access to oxigen or air.

5th. A temperature of from 68 to 95 degrees F.

The rapidity of formation of acetic acid depends largely upon the amount of oxigen or air supplied. By the old method of barrel fermentation a year or more was required, as the bacteria could only work on the surface. By the latter day process of percolating the alcoholic liquid through beech shavings but few days are required.

The process is chemically one of oxidation, aldehyde being an intermediate product. Thus:

$$\underset{\text{Alcohol}}{C_2H_5OH}+O=\underset{\text{Aldehyde}}{C_2H_4O}+H_2O$$

$$\underset{\text{Aldehyde}}{C_2H_4O}+O=\underset{\text{Acetic Acid}}{C_2H_4O_2}$$

Or expressed in one formula, structurally with chemical equivalents.

$$\begin{array}{llcll} \text{Alcohol} & \text{Oxygen} & & \text{Acetic acid} & \text{Water} \\ CH_3CH_2OH+ & O_2 & = & CH_3COOH+ & H_2O \\ 46.042 & 32. & & 60.028 & 18.014 \end{array}$$

Thus 60 parts or pounds of acetic acid are produced from 46 parts or pounds of alcohol, or 100 parts of alcohol by weight produce 130 parts of acetic acid. For every 132 pounds of acetic acid produced 3,777 cubic feet of air is used and must be supplied. In practice, however, there is considerable loss, due

1st. To incomplete oxidation.
   a. Alcohol remains unchanged.
   b. Alcohol changed into aldehyde.

2d. To volatilization.
   a. Of alcohol.
   b. Of aldehyde.
   c. Of acetic acid.

This loss is estimated by Wagner and others to amount to one-tenth. There is much less loss in winter than in summer. One vinegar firm in this state obtains in winter as high as 95 grain vinegar, or 9.5 per cent acetic acid, from 10 per cent alcohol, but in summer, from the same strength alcohol, only 6.2 per cent. 10 per cent alcohol should never make less than 80 grain vinegar; and I am inclined to think that that loss might be reduced.

During acetification there is also some change in the nitrogenized constituents; the more highly organized being changed into simpler combinations often to an insoluble state and precipitated on the shavings. The shavings must, therefore, be changed from time to time more often in cider vinegar manufacture. This change reduces somewhat the solids of cider vinegar, although not enough to necessitate any change in the law.

PROPERTIES.

The process described somewhat in detail, especially in regard to the chemical changes, is that in vogue in this country for the manufacture of low wine vinegar. The manufacturers of this vinegar, in order to deceive the public, slightly changed its name to white wine vinegar, under which name it is universally sold. To-day there is little gained by this, as people are well aware that white wine vinegar means a vinegar that was certainly not made from wine. The names, spirit vinegar, whisky vinegar and distilled vinegar are also appropriately given to this variety of vinegar.

When pure it is perfectly translucent and transparent, of about the same specific weight as water, which it resembles in outward appearance. It has a sharp, acid yet etherial odor and a biting but withal pleasant acid taste. When perfectly pure it should contain little or no solid, non-volatile material, yet as an article of commerce usually contains one per cent or more, probably derived from barreling. The only requirement of the state law is that it contain 4.5 per cent of absolute acetic acid and be free from poisonous or injurious substances. Low wine vinegar must of necessity be pure and wholesome.

In effectiveness it is second to none, and for some purposes as pickling it is undoubtedly superior. Some manufacturers believe that a low wine vinegar is best when taken from the acetifyers. This is a mistake, as low wine as well as cider vinegar improves with age, developing, in the manner described, the volatile ethers, which greatly improve the flavor.

Some complaint has been made by Chicago manufacturers that the Minnesota vinegar law and laws modeled after it are partial to cider vinegar. While a strict construction of the law could not reveal such favoritism, yet a casual glance might lead to the belief that such was the fact. As cider vinegar has different characteristics from other vinegar and is more costly, of necessity additional requirements must be made to protect the people from deception, else fraud would run rampant. This special protection of cider vinegar and the unwarranted inference that other kinds are more liable to contain foreign acids or poisonous mineral ingredients, may lead some to use cider vinegar who otherwise would buy the cheaper low wine vinegar. So let me emphasize here, that the only dietary difference between low wine and cider vinegar is the peculiar pleasant flavor of cider vinegar. The more than double price is paid simply to tickle the palate.

Low wine vinegar may be colored and flavored to imitate more expensive and highly prized vinegar. Thus with a generous addition of burnt sugar and a few drops of ethyl and butyl acetate low wine vinegar will closely resemble cider vinegar. Cochineal, archil or aniline colors dissolved in low wine vinegar to which the suggestive name of red wine vinegar is given is well calculated to deceive the public if not the retail dealer. When colored and flavored such vinegar has been sold under the attractive label of West India spiced, fruit vinegar, etc. Alden & Co. have sold considerable of this class of vinegar in the small towns in the state. However, not nearly as much of their illegal product has been found within the last two years as in previous years, and it is fair to state that many samples of pure cider vinegar of their make have been analyzed. States that have no food legislation are flooded with this class of misrepresented goods. Indeed, in some of our bordering states uncolored low wine vinegar is rarely sold.

MALT VINEGAR.

Malt vinegar is made by a process resembling that employed for low wine, until the distillation stage is reached. Malt vinegar is not distilled. The acetifiers are larger, holding from eight to ten thousand gallons. Instead of beech shavings birch twigs are used. The proportion of malt to unmalted grain is also much larger. The unmalted grain must be well dried or the keeping qualities of the vinegar will be greatly impaired. The alcoholic fermentation is pushed to the fullest extent, differing in this respect from the manufacture of malt liquors. The temperature of the acetifiers is about 110 degrees F. at the beginning of the process and about 100 degrees F. at the end. Properly conducted the entire process of making malt vinegar requires about two months. The extractive non-volatile matter of malt vinegar is high (5 to 10 per cent) and the acidity inclined to be low. Malt vinegar is a favorite in England and becoming more popular in this country. Much of the so-called malt vinegar on the market is not made as described, but often identically as low wine vinegar without distillation. Malt extract and low wine vinegar is a favorite prescription for the preparation of pure malt vinegar.

Beer vinegar is usually included in the same class as malt vinegar. Sometimes a large quantity of beer becomes sour and unfit for use as a beverage. It may be manufactured into a vinegar of low alcoholic strength. In order to be presentable it usually must be filtered through sand or some efficient filtering material. It is far inferior to true malt vinegar, and in contact with air will keep for a short time only.

Its keeping qualities, as well as its appearance, may be improved by filtering through fine sand. Malt vinegar or beer vinegar should contain at least 2 per cent of solids, or 2.5 per cent of ash to the original solids. In the absence of standards I should return as adulterated, or diluted with water or low wine vinegar any vinegar represented to be malt or beer vinegar which gave lower figures.

CIDER VINEGAR.

Cider vinegar is defined by our state law as the legitimate product of pure apple juice known as apple cider having an acidity equivalent to the presence of not less than four and one-half per cent by weight of absolute acetic acid and not less than two per cent by weight of cider vinegar solids upon full evaporation over boiling water. The principles of the process are precisely the same as in the manufacture of malt vinegar, beginning with the vinous fermentation. The old method of fermentation in casks has been largely superseded in the West by the quick process. When first made this vinegar is inferior to the old-time product, but improves somewhat with age.

The percentage of solids normal to cider vinegar is an important and much mooted question. By a very thorough investigation Dr. Davenport found that all samples of pure cider vinegar will contain at least 2 per cent of solids. Numerous analyses by Dr. Wallace of Philadelphia and the Dairy and Food commissions of New York and Minnesota have fully confirmed Dr. Davenport's conclusions.

The solids of cider vinegar are derived from the solid, non-volatile, soluble material of the apple. The quantity of this material varying so widely with the variety of the apple, native or grafted stock, the maturity of the fruit, the season and climatic condition, as well as the method of manufacture, as a matter of course the solids of cider vinegar are far from a constant quantity. Thus pure cider vinegar may give any figure from two to six per cent of solids. In very rare and exceptional cases the solids may fall a trifle below the minimum given; say 2.80 or 2.90 per cent. Before pronouncing judgment of all facts of analysis bearing upon the subject should be considered before certifying to the actual addition of water.

VARIOUS VARIETIES OF VINEGAR.

Besides the vinegar described there is occasionally found on the market:

White and red wine vinegar, derived from the fermentation of wine.

Crabapple vinegar, made from crabapples.

Perry vinegar, made by fermenting pear juice.

Beet vinegar, made from sugar beets.

Honey vinegar, made from fermentation of honey.

Glucose vinegar, from dextrose derived from starch.

Pyroligneous vinegar, a product of the destructive distillation of wood.

ADULTERATION.

PRESERVATIVES, MINERAL ACIDS AND SALTS.

Vinegar from any legitimate source, if properly made, requires no antiseptic to improve its keeping qualities. If of very low acidity or improperly manufactured cider and malt vinegar may easily spoil. Hence the use of foreign compounds.

For some purposes it is necessary to procure sweet cider, or perhaps cider that has not started acetous fermentation. Some agent to check fermentation must be used. For this purpose salicylic acid is a favorite.

Vinegar eels (angullula aceti) sometimes make their appearance in cider vinegar. The origin of these little animals was until recently unknown. M. Davaine has shown that they developed in most fruit, as the apple, plum, peach, cherry, etc., in great numbers, probably largely on the outside or rind. Thus their presence in cider vinegar may be easily explained. By the way, this fact may impress upon us the advantage of washing or carefully wiping the outside of fruit before eating. The eels require oxygen for existence, and, as the bacteria aceti also require air the eels seriously interfere with the production of acetic acid by the old process.

When present in vinegar they may be destroyed by the addition of boracic acid. However, this is, to say the least, a very objectionable method, although often used. A much better method and one that can cause no unpleasant consequences is to heat the vinegar to about 60 degrees centigrade, or 128 degrees Fahrenheit, which temperature kills the eels.

Sulphuric acid was at one time permitted by the regulations of the British excise to be added to vinegar in the proportion of one gallon of sulphuric acid to one thousand gallons of vinegar, or about .185 per cent by weight. It is now known that sulphuric acid is unnecessary for preservation of well made vinegar, and is seldom, if ever, used.

Other mineral acids are popularly supposed to be added to vinegar rather for the purpose of increasing acidity than preservation. The fact is that, although thousands of tests have been made, such sophistication has never to my knowledge been found. Their use in small quantity could hardly be very profitable and attended with such danger that no one of intelligence would use them.

Mainly through carelessness, sometimes unwittingly and perhaps unavoidably, mineral substances may be introduced into vinegar. Copper and iron may be dissolved by the liquid at some stage of vinegar manufacture coming in contact with these metals. There is more liability to contamination after the liquid has reached the acetic stage. As usually made, I think the small amount of iron often contained in vinegar is due to the action of acetic acid upon the iron bands surrounding the acetifyers. These bands, as is well known, last for a few months only before being almost entirely converted into iron oxid and acetate. Only a small portion of the iron finds its way through the staves and cracks to the vinegar within.

In the summer of 1893 a vinegar supposed to be the cause of poisoning in a number of families in Excelsior was found to contain .3033 per cent of arsenous oxide (the highly poisonous white arsenic of commerce).

This was equivalent to 14.12 grains arsenic per fluid ounce. As this amount is a saturated solution of arsenic in vinegar at ordinary temperatures I thought it likely that more arsenic in an insoluble condition remained in the barrel from which the samples were taken. On examination about one pound more of arsenic was found in the bottom of the barrel. There was then about two pounds of arsenic all told in the barrel. No clue to its introduction could be obtained. It was assuredly not introduced by the manufacturer either for the purpose of adulteration or by mistake.

In examining vinegar manufactured by the Gedney Vinegar Co. and Sioux City Vinegar Co., I have frequently met with considerable quantity of common salt. As I hardly think it could be introduced for preservation, or fraudulent purposes, the most probable views are that the vinegar has been once used in pickling, or that new vinegar was put in unwashed barrels in which pickles had been stored.

MISREPRESENTATION.

A most frequent adulteration is the sale of a cheaper for a high priced vinegar. Cider vinegar being the most costly is most subject to adulteration and misrepresentation. There are numerous methods employed for the sophistication of cider vinegar, an old and lucrative one is the use of pomace or second pressings. Mixing with other vinegars, as low wine and malt, is sometimes practiced; a fashionable one at one time was the addition of malt extract or grain solids. Cider vinegar is also made by simply coloring and flavoring low wine, or by mixing low wine and malt vinegar or malt extract and flavoring or not to suit the ingenuity of the manufacturer.

Addition of sweet cider or boiled cider, in sufficient quantity to make the legal amount of cider solids, has been resorted to in some instances. Additional coloring must, of course, be added in order to complete the deception.

A less obnoxious form of adulteration, if indeed it may be considered an adulteration, is the preparation of cider vinegar from cider syrup, instead of cider stock. Where apples are not native the cider is shipped from more favored localities. To save freight cider syrup or boiled cider is bought and diluted to the original consistency when it arrives at the factory. Vinegar is made by some Minnesota manufacturers confessedly in this manner. What effect the boiling may have on the quality of the product, I cannot say. Certainly it does not greatly change its chemical properties.

When pure cider vinegar is not sufficiently colored to suit the trade, caramel or burnt sugar is added. There can be no serious objection to this procedure.

DILUTION.

No form of adulteration of vinegar is so simple and convenient as dilution with water. It is applicable to all vinegars. Perhaps no other adulteration is so difficult to detect. Mainly for this reason standards of acids and solids have been made subject to enforcement by law. Low wine vinegar, as usually made, contains more than the legal requirements of acid; hence the necessity from an economic standpoint of reducing the strength to about 4.5 per cent, the state standard. That there is a tendency among manufacturers, whether intentionally or otherwise, to reduce their vinegar below the requirements of the law, may be noticed by examination of the table of analyses.

Six hundred and ninety-seven samples of vinegar have been analyzed in the period covered in this report. Of that number 108 or 15.5 per cent were misrepresented, and 119 or 17 per cent illegal, making a total of 227 or 32.8 per cent adulterated. Since the advance sheets of this report there was analyzed 168 samples. Fifty-two proved to be misrepresented, 75 were low in acid, while but 15 were deficient in solids.

Sometimes a sample was found deficient in both solids and acid. Such samples appear in two tables.

ILLEGAL VINEGAR.

NOT AS REPRESENTED.

MANUFACTURER.	Seller.	Sold for	Found to be.
Perry Salt Co.	Austin & Co., Minneapolis	Cider vinegar	Cider and malt.
W. J. Quare	N. Schumers, Caledonia	Cider vinegar	Colored low wine.
Burlington Vin. Works.	G. R. Hutchins, Lake City	Cider vinegar	Malt.
Mariam & Collins	G. Clement, Lake City	Cider vinegar	Cider and malt.
F. C. Johnson	E. F. McCall, Lake City	Cider vinegar	C'd'r & grain solids
F. C. Johnson	C. H. Greene & Co., Delano	Cider vinegar	
Red Cross Vin. Works	Fred Ayder, Howard Lake	Cider vinegar	Malt grain solids.
Red Cross Vin. Works	L. Rauch, Howard Lake	Cider vinegar	Malt.
Red Cross Vin. Works	Helgerson, Wells & Co., Litchfield	Cider vinegar	C'd'r & grain solids
Gedney Pickling Co.	Otto Peterson, Moornead	W. wine & cid'r	Low wine.
Red Cross Vin. Works	Wells Bros. & Hansen, Morris	Cider	C'd'r & grain solids
Spink & Son	A. Larson & Co., Willmar	Malt	Malt extract.
Spink & Son	Farmers' Mer. Co., Willmar	Red wine	Colored low wine.
Spink & Son	Manning & Co., Willmar	Cider	Malt.
Spink & Son	O. Mercall, Crookston	Cider	C'd'r & grain solids
Spink & Son	Thorp Mercantile Co., Ada	Cider	C'd'r & grain solids
Spink & Son	G. Gilbertson, Ada	Cider	Malt.
Spink & Son	Evansville Gro. Store, Evansville	Malt	Malt extract.
W., Farrington & Co.	Hans Flora, Osakis	Cider	Malt.
Spink & Son	S. M. Bassi, Sauk Centre	Cider	C'd'r & grain solids
Red Cross Vin. Works	Howe & Co., St. Cloud	Cider	Malt ex. & low w.
Spink & Son	Huff Bros., St. Cloud	Cider	C'd'r & grain solids
Charles E. Mayer & Co.	Olman Bros., Lake Benton	Cider	Colored low wine.
Heinze & Co.	A. W. Kendall, St. Paul	Cider	C'd'r & grain solids
N. W. Vin Works	Pioneer Tea & C. Co., St. Paul	Red wine	Colored low wine.
Geo. R. Newall & Co.	Ben Dahl, Minneapolis	Red wine	Low wine.
Dunham & Eastman	C. M. Taylor, Minneapolis	Cider vinegar	Colored low wine.
Red Cross Vin. Works	Levin Bros., St. Paul	Cider vinegar	C'd'r & grain solids
Gedney Pickling Co.	Orilius Bros., St. Paul	Cider vinegar	C'd'r & grain solids
Heinz & Co.	Olman Bros. (sp'l), Lake Benton	Cider vinegar	C'd'r & grain solids
Gedney Pickling Co.	Olman Bros. (sp'l), Lake Benton	No brand	C'd'r & grain solids
Gedney Pickling Co.	J. C. Higgins, Minneapolis	Cider	Colored low wine.
Red Cross Vin. Works	C. S. Gilbert & Co., Minneapolis	Cider	C'd'r & grain solids
Spink & Son	K. Aslen, Minneapolis	Cider	C'd'r & grain solids
Roth Mfg. Co.	O'Neal Bros., Stillwater	Cider	Colored low wine.
Gedney Pickling Co.	J. A. Johnson, Minneapolis	Cider	C'd'r & grain solids
Gedney Pickling Co.	Paul Nelson, Minneapolis	Cider	C'd'r & grain solids
Clarendon Vinegar Co.	Peterson & Fisher, Minneapolis	Cider	Malt.
Red Cross Vin. Works	Casey & Mason, Minneapolis	Cider	Malt.
Gedney Pickling Co.	D. H. Thornton, Minneapolis	Cider	C'd'r & grain solids
Heinz & Co.	J. P. Lunquest, Minneapolis	Cider	Malt.
Heinz & Co.	C. O. Haugan, Minneapolis	Cider	Malt.
Jas. Cushing & Sons	H. F. Buchner (sp'l), Redwood F.	Cider	Colored low wine.
N. W. Vin. Works	Pioneer Tea & C. Co., St. Paul	Red wine	Colored low wine.
Spink & Son	A. E. Belumberg, St. Paul	Cider	C'd'r & grain solids
Monarch Vin. Works	Burns Bros., St. Paul	Cider	Colored low wine.
Sioux C. V. & P. W'ks.	Farmers' Mer. Co. (sp'l), Adrian	Cider	Colored low wine.
Heinz & Co.	Cormea & Dulde, St. Paul	Cider	Malt.
Heinz & Co.	J. P. Lunquest, Minneapolis	Cider	Malt.
Red Cross Vin. Works	C. P. Hunter, Minneapolis	Cider	C'd'r & grain solids
Gedney Pickling Co.	Webber Gro. Co., Minneapolis	Cider	Repressing.

DEFICIENT IN SOLIDS.

C. E. Meyers & Co.	C. E. Meyers & Co., not given	Cider	Cider.
Perry Salt Co.	Austin & Co., Minneapolis	Cider	Cider and malt.
F. C. Johnson	E. F. McCall, Lake City	Cider	C'd'r & grain solids
F. C. Johnson	C. H. Green & Co., Delano	Cider	Low wine.
Duffy	S. F. Swanson & Co., Cocato	Cider	Cider.
Alden Vin. Works	Special, St. Paul	Cider	Cider.
F. H. Spink & Son	Holm & Nelson, Minneapolis	Cider	Cider.
F. H. Spink & Son	West 7th St. Gro. Co., St. Paul	Cider	Cider.
Gedney Pickling Works.	Olman Bros., Lake Benton	No brand	C'd'r & grain solids
Gedney Pickling Works.	John Hansen, Minneapolis	Cider	Cider.
Gedney Pickling Works.	Anderson Bros., Minneapolis	Cider	Cider.
Spink & Son	E. Bellemberg, St. Paul	Cider	C'd'r & grain solids
F. C. Johnson	James Kenally, St. Paul	Cider	Cider.
Spink & Son	Herman Hauett, St. Paul	Cider	Cider.
Gedney Pickling Works.	R. Oxman, St. Paul	Cider	Cider.

ILLEGAL VINEGAR—*Continued.*

DEFICIENT IN ACID.

MANUFACTURER.	Seller.	Sold for.	Found to be.
T. C. Johnson	Morgan & Co., Howard Lake	Cider vinegar	C'd'r & grain solids
T. C. Johnson	John Palm & Co., Litchfield	Cider vinegar	Low wine.
Spink & Son	E. F. McCall, Lake City	Malt	Malt.
Dunham & Johnson	C. H. Green & Co., Delano	Cider	Cider.
Gedney Pickling Co	John Kleck, Delano	Cider	Cider.
Spink & Son	Patterson, Stark & Co., Litchfield.	Malt	Malt.
Gedney Pickling Co	Leslie Welter, Moorhead.	Cider	Cider.
Red Cross Vin. Works	Wells Bros. & Hansen, Morris	Cider	C'd'r & grain solids
Griggs, Cooper & Co	Halverson & Peters, Benson	White wine	Low wine.
Spink & Son	A. Larson & Co., Willmar	Malt	Malt extract.
Spink & Son	Farmers' Mercantile Co., Willmar.	Red wine	Colored low wine.
Anthony Kelly Mer. Co.	Burr & Johnson, Willmar	Cider	Cider.
Spink & Son	Manning & Co., Willmar	Cider	Malt.
Gedney Pickling Co	Cleary Bros., Crookston	Cider	Cider.
Spink & Son	O. Mercell, Crookston	Cider	C'd'r & grain solids
Spink & Son	Thorp Mercantile Co., Ada	Cider	C'd'r & grain solids
Gedney Pickling Co.	Bangs & Co., Ada	Cider	Cider.
F. H. Spink & Son	Evansville Gro. Store, Evansville.	Malt	Malt extract.
F. H. Spink & Son	Evansville Gro. Store, Evansville.	White wine	Low wine.
N. W. Vin. Works	J. A. McCauley, Fergus Falls	Cider	Cider.
N. W. Vin. Works	J. A. McCauley, Fergus Falls	White wine	Low wine.
Johnson	J. Mackerdal, St. Cloud	Cider	C'd'r & grain solids
Red Cross Vin. Works	Howe & Co., Sauk Centre	Cider	Malt ex. & low w.
Unknown	A. W. Malbey, St. Charles		Malt.
Sioux City Vin. Works.	Olmund Bros., Lake Benton		Malt.
Heinz & Co	A. W. Kendall, St. Paul	Cider	C'd'r & grain solids
F. H. Spink & Son	Holm & Nelson, Minneapolis	Cider	C'd'r & grain solids
G. R. Newall & Co	Ben Dahl, Minneapolis	Red wine	Low wine.
N. W. Vin. Works	J. W. Goodsell, St. Paul	Cider	Cider.
Dunham & Eastman	Edmund Nelson, Minneapolis	White wine	Low wine.
Price Pickling Co	J. P. Schoomer, Minneapolis	White wine	Cider.
Red Cross Vin. Works	Levin Bros., St. Paul	Cider	C'd'r & grain solids
Gedney Pickling Co	Arilius Bros., St. Paul	Cider	C'd'r & grain solids
Unknown	Olmun Bros. (sp'l), Lake Benton		Colored low wine.
Gedney Pickling Co	Olmun Bros. (sp'l), Lake Benton	Cider	C'd'r & grain solids
L. Patterson & Co	Olmun Bros. (sp'l), Lake Benton	White wine	Low wine.
Heinz & Co	C. S. Gilbert & Co., Minneapolis	White wine	Low wine.
F. H. Spink & Son	K. Olsen, Minneapolis	Cider	C'd'r & grain solids
F. H. Spink & Son	K. Olsen, Minneapolis	White wine	Low wine.
Gedney Pickling Co	J. S. Levinson, Minneapolis	White wine	Low wine.
Heinz & Co	Sam'l Mathews & Co., Stillwater	Malt	Malt.
Roth Mfg. Co	O'Neal Bros., Stillwater	Cider	Cider & low wine.
F. H. Spink & Son	J. A. Johnson, Minneapolis	White wine	Low wine.
Gedney Pickling Co	J. A. Johnson, Minneapolis	Cider	C'd'r & grain solids
Gedney Pickling Co	Peterson & Lindal, Minneapolis	White wine	Low wine.
Gedney Pickling Co	Peterson & Lindal, Minneapolis	Cider	Cider.
Gedney Pickling Co	Paul Nelson, Minneapolis	White wine	Low wine.
Dunham & Eastman	N. W. Fish & Co., Minneapolis	White wine	Low wine.
Harrison & Winston	J. C. Daunce, Minneapolis	Cider	Cider.
Farrington & Winston.	Swan Anderson, Minneapolis	Cider	Cider.
Red Cross Vin. Works	Kasey & Mason, Minneapolis	Cider	Malt.
Gedney Pickling Co	Moss & Jackson, Minneapolis	White wine	Low wine.
F. O. Johnson	W. H. Allen, Minneapolis	Cider	Cider.
Gedney Pickling Co	D. H. Thornton, Minneapolis	Cider	C'd'r & grain solids
Gedney Pickling Co	Anderson Bros., Minneapolis	Cider	Cider.
Heinz & Co	C. O. Haugen, Minneapolis	Cider	Malt.
Gedney Pickling Works.	J. R. Curl, Minneapolis	Cider	Cider.
Spink & Son	A. Anderson, Minneapolis	Cider	Cider.
G. R. Newall & Co	A. Anderson, Minneapolis	White wine	Low wine.
Gedney Pickling Co	Zepoy & Rude, Minneapolis	Cider	Cider.
N. W. Vin. Works	Pioneer Tea Co., St. Paul	Red wine	Low wine.
Duffy	F. Benjamin, St. Paul	Cider	Cider.
Gedney Pickling Co	C. Anderson, St. Paul	Cider	Cider.
Spink & Son	E. Bellamby, St. Paul	Cider	C'd'r & grain solids
N. W. Vin. Works	St. Paul Tea & C. Co., St. Paul	White wine	Low wine.
Barrett & Barrett	Mrs. R. Truax, St. Paul	White wine	Low wine.
Monarch Vin. Works	Burns Bros., St. Paul	Cider	Colored low wine.
Sioux C. V. & P. W'ks.	Farmers' Mer. Co. (sp'l), Adrian	Cider	Colored low wine.
Spink & Son	Furbur Bros., St. Paul	Cider	Cider.
N. W. Vin. Works	M. Camero, St. Paul	White wine	Low wine.
Miller, Pettigill & F.	F. M. Durgin, Minneapolis	Cider	Cider.
Gedney Pickling Co	F. A. Bastis, Minneapolis	White wine	Low wine.
Gedney Pickling Co	E. Nall, Minneapolis	White wine	Low wine.
Spink & Son	D. W. Horrigan, St. Paul	Cider	Cider.
Gedney Pickling Co	Yerxa Bros., St. Paul	White wine	Low wine.

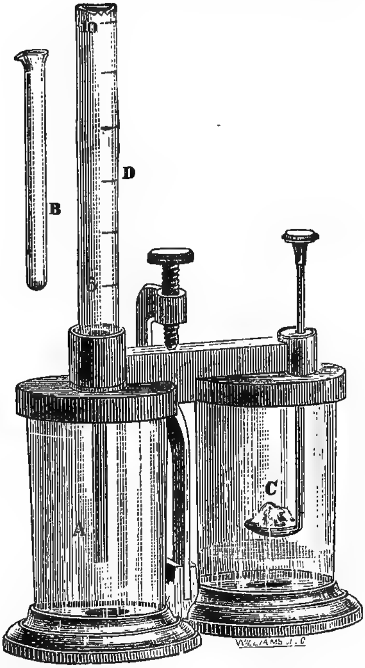
SUGGESTIONS TO PRODUCERS.

Vinegar manufacturers, I find, have little, if any, knowledge of the process they conduct from day to day. The only method followed is domineered by the rule of thumb. Hence improvement in manipulation and manufacture are but slowly effected. Experience is of more value than conjecture or supposition. Practice is preferable to untried theory, while a little knowledge is even more dangerous than blind precept. So, while by no means decrying custom, I nevertheless believe that with more insight into the principles of the process a better and cheaper vinegar can be made. "Science with practice" should be the motto of the manufacturer.

In conformity with this view the process of manufacture is described in the previous article. In these pages a few suggestions are offered, bearing upon the application of the principles to every day practice.

In the manufacture of vinegar there is undoubtedly more waste than necessary in converting starch and sugar into acetic acid. Every pound of unconverted starch or maltose means a loss of seven-tenths of a pound of acetic acid. Every pound of sugar not converted into alcohol means an absolute loss of seven-tenths of a pound of anhydrous acetic acid. Every pound of alcohol remaining in the vinegar means the loss of the selling price of one and three-tenths pounds of acetic acid.

The loss of one pound in every conversion would mean the loss of three and four-tenths pounds of absolute acetic acid, equivalent to 325 pounds of standard vinegar. Acetic acid is the one valuable ingredient of vinegar, therefore every care should be taken that each process is completed in turn, and that there is not day after day an excessive loss due to volatilization of alcohol, aldehyde and acetic acid in the generators. Many of the operations can be controlled only by the services of an analytical chemist. The most important feature, however, the formation of alcohol and subsequent distillation, can be accurately, practically and economically gauged by the intelligent use of correctly calibrated hydrometers. Those especially constructed for the determination of alcohol by its specific gravity and tested by reliable firms are to be preferred. The hydrometer, however, is not applicable to acetic acid on account of the disturbing influence of other substances, and the relatively small difference in the specific gravity of hydrated acetic acid and water. There are other simple methods, however, depending on the property of acetic acid to combine with alkalies, which, with special instruments, are as convenient and more accurate than the alcohol determination by the hydrometer.



Twichell's test here illustrated is in common use, and is probably accurate enough for practical purposes. The conditions governing its accuracy are:

1st. That the instrument is accurately adjusted and calibrated.

2d. That care be taken in measuring the liquids and making the test.

3d. That the sodium carbonate employed be approximately chemically pure.

The difficulty of obtaining perfectly adjusted instruments and pure sodium carbonate should be sufficient inducement to manufacturers to adopt the usual practice of chemists for the determination of acetic acid in clear liquid where no other acid is present, i. e., its volumetric determination by comparing it with an alkali of known strength. Take for example the alkali, sodium hydrate and acetic acid. Sixty grams acetic acid is always neutralized by 40 grams sodium hydrate. So if we take 60 grams of acetic acid, and it required 40 grams of sodium hydrate for neutralization, the acetic acid would be proven chemically pure, or 100 per cent absolute acetic acid. If but 20 grams were required, the acetic acid would be only 50 per cent pure. If but one gram were required the solution would contain only 2.5 per cent of absolute acetic acid. But it is impossible to use sodium hydrate in its usual solid state for two reasons: First (applicable to all alkalies), it would be impossible to see when the neutral point was reached with sufficient accuracy. Second, sodium hydrate absorbs water greedily from the air, therefore its weight cannot be exactly taken, nor can it be handled without danger.

Therefore the alkali is dissolved in a known volume of water so that the amount of active alkali, in any given volume, is known. Obviously, just for convenience, it is best to make it upon the decimal or metric system, say 40 grams in 100 cubic centimeters, or to simplify and use less quantity; 4 grams in 100 C. c. which will neutralize 6 grams acetic acid instead of 60 grams. If, for a solution of 6 grams acetic acid or vinegar it require all of the 100 C. c., it would be absolute acetic acid, or 100 per cent. If but 1 C. c. of the alkali were required the solution would contain 1 per cent acetic acid. To get absolutely accurate results it would be necessary to weigh out the 6 grams of vinegar, but in practice as 1 C. c. of water weighs one gram and vinegar is but a trifle heavier no appreciable error is made by taking a volume of 6 cubic centimeters and assuming that it weighs 6 grams. Special pipettes holding 6 C. c. are made for the purpose.

To establish the point of neutrality an alcoholic solution of phenol-phthalein, a coal tar product, is probably the best. It is colorless in an alcoholic solution, turns red with excess of alkali and becomes colorless with acid. The color of cider vinegar somewhat interferes with the sensitiveness of the indicator. This is not noticeable, however, with as strong solution of alkali as above given (4 grams in 100 C. c., or a normal solution).

The test is in practice carried out as follows: 6 C. c. of vinegar are measured in a pipette and transferred to a beaker. About two drops of phenolphthalein are added in low wine and six to eight drops in cider. Cider vinegar should be diluted after measuring with five or six volumes of water. The beaker is placed over a white surface and normal sodium hydrate added from a burette until the addition of one drop turns the liquid from a colorless or light straw color to bright red. The number of C. c. of alkali used equals the per cent of acid calculated as acetic.

With cider vinegar a small error is introduced in calculating the minute amount of malic acid as acetic.

The chemicals and apparatus required are as follows:

A normal solution of sodium hydrate.

One per cent solution of phenolphthalein in 50 per cent alcohol.

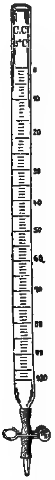
One celibrated burette, capacity 50 C. c. accurately draduated to one-tenth C. c.

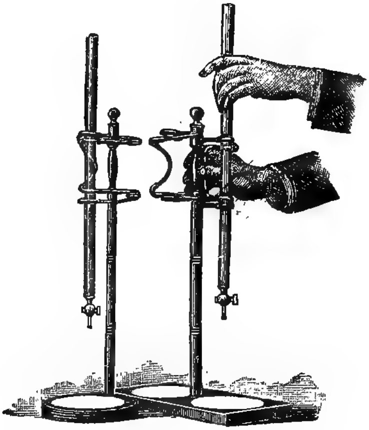
One 6 C. c. pipette.

16 c. c. pipette.

One or more beakers.

Everything needed in this method of determination of the strength of vinegar, including 1 Seter of normal alkali and one-half Seter phenolphthalein may be obtained from Richards & Co., Limited, 112 to 114 Lake street, Chicago, for $5.50 net. The retail price is considerably more. Through the kindness of the above firm the apparatus supplied is illustrated. The same apparatus probably may be obtained of any large dealer in chemical apparatus and supplies.





By careful manipulation with this method and correct calculation from the data obtained the losses in manufacture can be checked, and no loss of contracts necessitated because the vinegar does not come up to the quality demanded. Low wine vinegar and possibly cider must be manufactured of greater strength than required by law or demanded by the epicure. Consequently its reduction to the state standard is a matter of dollars, not cents, to the producer. On the other hand if too much water is added he is put in the light of an offender against law and subject to its punishment. Therefore it is important to the honest producer, as well as to the commission, that improved methods and accurate instruments be employed. The desired result would be that no unintentionally illegal vinegar would be found, and a more uniform and lawful product placed upon the market.

Greater care should be taken by manufacturers of cider vinegar in the purchase of cider stock and cider syrup. Check the buying of cider syrup and cider stock by means of the hydrometer. The more solids the cider stock contains the more valuable, other things being equal, it is for vinegar manufacture. A good way when a large quantity of stock is bought is to take, say 500 C. c. Note its gravity with the hydrometer. Boil off about 100 C. c., dilute to the original volume and again take the gravity. The last gravity will give information as to the exact amount of solids present, and the difference between the first and last gravity by referring to alcohol tables will show the percentage of alcohol already generated. The purchase of cider stock or syrup from a reliable firm is not always a guarantee of purity.

BAKING POWDER.

Perhaps no article of food, or substance entering into the preparation of food, has been forced so prominently before the people as the various brands of baking powder. At no time has the rivalry been so fierce as at present. Our state law only requires the manufacturers of alum, or alum phospate, baking powder to label their cans so that the public may not be deceived in the quality of goods they are purchasing. In many states the sale of such powders is prohibited by law. Notwithstanding our leniency in this matter, it is not unusual to find alum powders labeled in such a manner that it will not be noticed by the purchaser. Almost all such powders are accompanied by a "bluff," as "warranted absolutely pure," $10,000 reward to any person finding a trace of alum, etc.

Baking powders consist essentially of an acid, an alkaline carbonate and a "filler." The alkali may be sodium or potassium carbonate or bicarbonate. In the baking powders of commerce sodium bicarbonate is almost exclusively used. Ammonium carbonate in combination with sodium bicarbonate is sometimes employed. The acid element largely governs the value of a baking powder, and with respect to the acid used they may be classified as follows:

1. Tartaric acid.
    - a. Tartaric acid.
    - b. Potassium bitartrate (cream of tartar).
2. Phosphoric acid.
    - a. Acid phosphate of calsium.
3. Sulphuric acid.
    - a. Sodium and potassium aluninum sulphate (common alum.)
    - b. Ammonium aluninum sulphate (ammonium alum.)

In almost all the baking powders offered for sale in Minnesota to-day the acid ingredient is either cream of tartar or a mixture of common alum and acid phosphate of calsium.

While terra alba, flour, sugar and starch may serve as a filler, starch is as good as any, is cheap, and very generally used.

The least objectionable class, or cream of tartar powders, concerns us but little, unless in an advisory way. Their number is legion. Contrary to the statement of each individual manufacturer, there is no great difference between them. The conditions determining their value are:

1. Pure and dry material.
2. Proper and thorough mixing.
3. Judicious "filling."

Practically the only difficulty in their manufacture is in mixing the ingredients in the correct proportion. If this is done, as it is perfectly feasible to do with cream of tartar and soda of uniform strength, the value of the powder depends upon the starch "filler." The purpose of the filler is to separate the chemicals, so that they will not combine before wanted, and thus lose strength. Some manufacturers sacrifice a little strength to keeping quality. Twenty per cent of starch is about the minimum amount that should be present in a powder expected to keep.

In July of the present year there appeared in the advertising supplement of the "Cosmopolitan" an article entitled, "Some Sanitary Aspects of Bread Making," by Cyrus Edson, M. D., Commissioner of Health, New York City. Nominally it is a caution against using yeast raised bread; practically it is an advertisement of a certain baking powder. Indeed, the veil behind which he writes is much too thin to conceal the motive, even to the least observing. Therein he makes some statements which would be surprising from an unprofessional man, astounding from an M. D., and unheard of from a man occupying a position of public trust. For example, he says: "Baking powders are composed of an acid and an alkali which, if properly combined, should, when they unite, at once, *destroy* themselves and produce carbonic acid gas. * * * A good baking powder does its work while the loaf is in the oven, and having done it *disappears*. * * * The best baking powder made is, as shown by analysis, "The Royal." It contains absolutely nothing but cream of tartar and soda, refined to a chemical purity, which, when combined under the influence of heat and moisture, produce carbonic acid gas, and having done this *disappear*."

This is true of no baking powder whatever. As may be seen below, the carbonic acid gas formed in the most perfectly made baking powder from pure material amounts to only 12.94 per cent, and the remaining 87.06 per cent, with the possible exception of a portion of the water formed, remain in the bread, even after baking. Materials do not disappear as mysteriously in the realm of science as in legerdemain.

Only two years ago cream of tartar containing less than six per cent foreign material was as good as could be obtained at a moderate price. To-day it is possible to obtain it in any quantity 99 1-2 pure. This advance in chemical technology should show a corresponding increase in strength and purity of baking powder.

It also necessitates a change in the formula for a perfect powder. Calculating from the standpoint of a 100 per cent cream of tartar, and allowing 20 per cent for starch filling we derive the formula:

Starch	20.000	per cent.
Cream of tartar	55.296	per cent.
Sodium bicarbonate	24.704	per cent.
	100.000	

This powder should yield 12.949 of available gas. This is dissipated upon heating. There remains in the bread as a further product of the combination:

Starch filler	20	per cent.
Potassium sodium tartrate	61.76	per cent. (Rochelle Salt.)
Water	5.30	
Total	87.06	
Carbonic acid gas escaped	12.94	
Total	100.00	

It will be noticed that some of the recorded analyses approach very close to the standard of excellence. One sample is even higher, but that powder does not contain sufficient flour "filler" to hold its strength long in contact with air.

Comparatively few acid phosphate powders are on the market. No objection has been urged against them from the standpoint of public health.

The "straight" alum powder, i. e., containing no other acid ingredient than sulphuric acid in some combination, although at one time very popular, is now almost entirely superseded by a mixed powder containing a part of its acid as common alum and a part as acid phosphate of calsium.

The reaction taking place in the bread and the consequent residue depend to some extent upon the proportion of acid phosphate of calcium used. However, the principal dissimilarity from straight alum powder is the formation of aluminum phosphate instead of aluminum hydrate and sulphate of calsium in place of a part of the sulphate of sodium. The aluminum phosphate is perhaps less soluble in the digestive juices than aluminum hydrate.

A summary of the evidence pro and con up to date of the influence of alum and alum phosphate powders upon health is recorded in the fourth biennial report of this commission, page 115. Dr. C. A. Crampton, after studying the subject for the secretary of agriculture, announces the following conclusions:

"1. That form of alum powder in which sufficient phosphate is added to combine with all aluminum present is a better form, and less apt to bring alum into the system than where alum alone is used.

"2. It must be expected that small quantities at least of alum will be absorbed by the digestive fluids when any form of powder containing it is used.

"3. Whether the absorption of small quantities of alum into the human system would be productive of serious effects is still an open question, and one that careful physiological experiment alone can decide."

A general summary of the conclusions reached by Prof. Mallet, more particularly concerning the alum phosphate baking powder, are as follows:

(a) The greater part of the alum baking powders in the American market are made with alum, the acid phospate of calcium, bicarbonate of sodium and starch.

(b) These powders, as found in retail trade, give off very different proportions of carbonic acid gas, and therefore require to be used in different proportion with the same quantity of flour, some of the inferior powders in largely increased amount to produce the requisite porosity in bread.

(c) In these powders there is generally present an excess of the alkaline ingredient, but this excess varies in amount, and there is sometimes found, on the contrary, an excess of acid material.

(d) On moistening with water these powders, even when containing an excess of alkaline material, yield small quantities of aluminium and calcium in a soluble condition.

(e) As a consequence of the common employment of calcium-acid phosphate along with alum in the manufacture of baking powders, these, after use in bread-making, leave, at any rate, most of the aluminium in the form of phospate. When alum alone is used the phosphate is replaced by hydroxide.

(f) The temperature to which the interior of bread is exposed in baking does not exceed 212 degrees F.

(g) At the temperature of 212 degrees F. neither the "water of combination" of aluminium hydroxide nor the whole of the associated water of either this or the phosphate is removed in baking bread containing these substances as residues from baking powder.

(h) In doses not very greatly exceeding such quantities as may be derived from bread as commonly used, aluminium hydroxide and phosphate produce, or produced in experiments upon myself, an inhabitory effect upon gastric digestion.

(i) This effect is probably a consequence of the fact that a part of the aluminium unites with the acid of the gastric juice and is taken up into solution, while at the same time the remainder of the aluminium hydroxide or phosphate throws down in insoluble form the organic substance constituting the peptic ferment.

(k) Partial precipitation in insoluble form of some of the organic matter of food may probably also be brought about by the presence of the aluminium compounds in question.

(l) From the general nature of the results obtained, the conclusion may fairly be deduced that, not only alum itself, but the residues which its use in baking powder leaves in bread, cannot be viewed as harmless, but must be ranked as objectionable, and should be avoided when the object aimed at is the production of wholesome bread.

An interesting fact bearing upon the relation of alum in baking powders to public health came under my own observation this summer. As far as I am aware no case of a similar nature has been recorded. A family of four persons partook of a breakfast consisting principally of corn cake. The family consisted of the husband and wife, age about 40, their mother aged about 65, and a robust boy, age about 20. The husband said the cake tasted "bitter" and would not eat it. The others insisted that the cake was all right, and to prove their assertion ate perhaps more of the cake than they ordinarily would, especially the boy, who ate not less than a pound—probably more. While still eating the cake they commenced to feel ill, and the wife and boy vomited. The boy was the most distressed at the time, as the vomiting and retching continued all day, ejecting some blood. The husband who had not eaten the cake was unaffected. The aged mother who did not vomit was quite sick for three or four days.

A physician was called who said the physiological effects indicated a metallic poison. The only new material in the cake they had not before eaten was the baking powder. This the cook admitted using in very large quantities. The baking powder they had received free, and the cook was illiterate and could not read the directions.

I found the powder to be an alum phosphate powder, much deteriorated by long exposure. I found no metallic poison, in the usually accepted sense, in the powder.

I also obtained a sample of the corn cake. This was found to contain .2 per cent of aluminum oxid, or 1.01 per cent of potassium aluminum sulphate, or burnt alum. The corn cake contained, then, 58.15 grains of dried potassium alum, or 106.7 grains of crystallized potassium alum per pound apothecary. This is a larger amount than is usually found in a loaf of bread made from one quart of flour. Some peculiarity in the method of baking this corn cake must have left at least a part of the alum in the form of the soluble salt—burnt alum. This, with the heaviness or soginess of the cake, the large quantity eaten, and above all, the large amount of powder used in baking, were undoubtedly factors which made the physiological effects so severe. At all events this case proves that under certain conditions alum powders may be decidedly injurious to health. It is also true that these conditions are not likely often to occur. In another portion of the report appears a revised list of alum powders.

ANALYSES OF BAKING POWDER.

Manufacturer and Name of Powder.	Total Carbonic Acid.	Dry Alum Per Cent.	Found to be.	Labeled
Vouwie Bro..........May Flower	8.42	15.47	Alum powder...	No.
McNeil & Higgins..........New Chicago	9.12	15.76	Alum phosphate	No.
J. G. Flint..........White Rose	8.94	14.71	Alum phosphate	No.
Zep & Schowndoffer..........Eclipse	4.86	16.42	Alum phosphate	No.
Spa B. P. Co..........“Spa”			Alum phosphate	No.
American Soda Works..........Old Abe	10.83		Cream tartar...	
Chas. F. Glockner..........Bee Hive	10.04		Cream tartar...	
Yerxa Bros..........Yerxa Extra	10.85		Cream tartar...	
Columbian Coffee Co..........Regal	11.21		Cream tartar...	
Mariam Collins & Co..........Imperial	9.40	26.68	Alum phosphate	No.
Calumet Baking Powder Co..........Calumet	11.37	25.31	Alum phosphate	No.
Calumet Baking Powder Co..........Calumet	11.37	25.31	Alum phosphate	No.
Park & Nelson..........P & N	12.70		Pure cream tar.	
Capital City Pharmacy..........Capital	13.47		Pure cream tar.	
Unknown..........Pure	11.93		Pure cream tar.	
Reed, Murdock & Fisher..........The Pure	10.80		Cream tar pow.	
Calumet Baking Powder Co..........Calumet			Alum phosphate	
Puhl & Webb..........Sweet Biscuit	10.92	20.75	Alum phosphate	
Jos. Marieu..........T. & M.			Cream of tartar	
Kent & Brady..........The St. Paul	10.12	27.74	Alum phosphate	No.
..........Vassar	12.30	15.19	Alum powder...	*
U. S. A. Baking Powder Mnfg....U. S. A.			Cream tar. pow.	
Dr. Fry..........Dr. Fry Baking Powder			Cream tar. pow.	
..........The Palace			Alum....	No.
C. F. Blanke Tea & Coffee Co..Eagle Brand			Alum phosphate	No.
Toledo Spice Co..........Victor			Alum phosphate	No.
J. N. Pelton..........Roy’s Baking Powder			Cream of tartar	
Chaplin, Smith & Co. Chicago Yeast Powder			Alum phosphate	No.
..........Monarch			Alum phosphate	No.
Gem City Mnfg Co. (sent in)..........Perfect			Alum phosphate	**
Gem City Mnfg Co. (sent in)..........Sea Foam			Cream of tartar	

*Obscurely labeled. **Labeled.

HONEY.

The honey law enacted by the legislature of 1893 adds another article to the increasing list of adulterated foods prohibited by law and imposed additional duties upon the chemist.

Although Minnesota is not the first state to make laws to prevent fraud in the sale of honey, the few states that have such laws have taken no active steps to enforce them, and but two or three analyses are recorded. A number of analyses of extracted honey taken from different parts of the United States, made under the direction of the U. S. Department of Agriculture, show a percentage of adulteration in the various states as follows:

Seventy-six per cent in Nebraska.
Eighteen per cent in California.
Twenty-six per cent in Kentucky.
Twelve per cent in Massachusetts.
Thirty-four per cent in New Orleans.
Fifty-eight per cent in Pennsylvania.
Forty per cent in Ohio.
Forty-eight per cent in New York.

In calculating the percentage of adulteration all honey suspected of being adulterated with invert sugar, but not susceptible of positive proof were classed as pure honey. It will be observed that this investigation, although extensive, was mainly conducted along coast lines.

Nebraska is the only representative of the great corn and glucose producing territory between Ohio and California. It was in Nebraska that the highest percentage of adulterated honey was found.

Beekeepers seem to have been the last to recognize such a commodity as adulterated honey. Yet honey was adulterated extensively with cane sugar as far back as 1865.

The manufacture of glucose gave an increased impetus to adulteration, as it had advantages not possessed by cane sugar or other adulterants. Within the last few years honey, especially extracted honey, has been sold so cheap that it was not thought profitable to adulterate it. The "American Bee Journal" of July, 1888, says: "Adulteration of honey is now a thing of the past." Owing to the immense yield of California, honey is to-day cheaper than ever. But glucose and cane sugar have decreased in value in still greater ratio. The work of the U. S. Department of Agriculture in 1891 and my own work on honey offered for sale in Minnesota in 1893 and 1894 show that there is still balm for a seared conscience and sufficient inducement in the sophistication of extracted honey to hazard detection and punishment.

Various patents have been issued for making artificial honey from invert sugar, and undoubtedly there is some honey on the market illustrating the truth that the busy bee has no monopoly upon industry. There is a popular impression that comb honey is manufactured, comb and all, but such is probably a misapprehension, as such article has never been found, although believed by many scientists to be plausible. The popular belief is probably founded upon the fact that artificial comb foundations are made and largely used. Thus far beeswax has been found superior to all other plastic substances in the manufacture of comb foundations.

Iron and tin combs have been employed, at least, in an experimental way.

A comprehensive definition of honey must include the saccarine liquid food secreted by the honey bee, *apis mellifica;* the humble bee, *bombus pennsylvanicus,* or other hymenopterous insect. Wiley (1891) defines honey as the transformed nectar from flowers. Cook (1893) would modify this definition to conform to our more extensive knowledge of the food of bees and our limited knowledge of honey by defining honey as simply transformed nectar. This definition, to be sure, would include aphis or louse honey, but would it include honey obtained by feeding bees cane sugar, etc., a form of honey met with and very difficult, if not impossible, to distinguish from flower honey.

In view of the wording and spirit of our state law it would be proper to make the following restrictions: "Commercial honey is the nectar of flowers transformed and stored in a comb by the honey bee." As stated by Cook, honey dew honey is so unattractive in appearance as to be rarely found upon the market. Honey from other insects than the honey bee is not produced in sufficient quantity to give it commercial standing. Honey produced by artificial feeding of bees is prohibited by statute.

The physical properties of honey depend somewhat upon the variety of bee producing it, but much more upon the food of the bee. Honey obtained from basswood is nearly white, while that from goldenrod and buckwheat is almost black. The peculiar taste of honey is due to small particles of pollen of plants and other adhering organic material, and therefore also depends upon the food of the bees. The viscosity of honey varies from a limpid to a viscid syrup, depending when pure upon the rapidity of accumulation and length of time in storage. Honey containing more than 23 per cent of water may safely be regarded as diluted.

Chemically considered, honey is a water solution of sucro-dextrose and sucro-levulose (invert sugar) with smaller amount of sucrose (cane sugar), mannite (a sugar), and dextrin (a gum). Smaller quantities of formic acid and other organic and mineral matter are invariably present.

The physiological process of converting nectar and sugar into honey is very little understood. The constitution of nectar can only be approximated, as it is obtainable in such very small quantity. Yet it certainly contains a much larger proportion of sucrose and dextrin than is found in honey. Watts affirms that the sugar is converted into glucose by a ferment in the honey. Cook, with more reason, thinks that the large compound racemose glands in the head and thorax of bees furnish the ferment, which induces the change. In view of the fact that the inversion of cane sugar is seldom complete, Mr. Doolittle thinks that the young bees work over the honey and more thoroughly digest it. Perhaps drones and queen bees which are also provided with these glands also work over the honey.

In 1885 Prof. Wiley called attention to honey collected in pine regions, evidently collected from pine tree honey dew. It is now known that such nectar is obtained from secretions of aphides (plant lice) which infest not alone pine trees but most vegetation. Honey produced in this manner from flora of any locality is termed "honey dew honey," and has the following characteristics: Usually dark in color, rank in flavor and unfit for market. It is distinguished chemically from other honey by a dextro-rotary, or slightly levo-rotary, rotation of polarized light, a low percentage of invert sugar and a high percentage of ash.

Bees store honey very rapidly when fed cane sugar. At certain seasons of the year, when other food is scarce, or for wintering the bees, it may be necessary, or, at all events, advantageous to use artificial food. Yet the beekeepers' association rightly discriminate between such honey and that produced from nectar. Honey made in this manner if accumulated rapidly and collected soon after storing always contains an abnormal quantity of cane sugar. If such honey is kept for some time in the hive it will be found to contain almost the same constitution as honey from flowers,

If the liquid portion be separated from the solid portion of partly granulated honey the liquid will contain most of the levulose and but little dextrose, and consequently will have a marked levorotary action on polarized light. This may explain the marked (—) rotation of some of the honey analyzed (see table). In this connection it may be mentioned that all honey will granulate in time, therefore honey warranted to remain liquid is probably adulterated. Granulated honey is, however, no proof of purity.

ADULTERATION.

Honey may be adulterated in four ways; by additions of solutions of glucose, of sucrose and of invert sugar and by dilution with water.

Glucose is producted by the action of dilute sulphuric or oxalic acid upon starch, in an open or closed vessel, with or without pressure.

The conditions of the manufacture govern the quality of the syrup produced. If the boiling be conducted in an open vessel only a part of the starch will be converted into dextrose, the remaining portion forming dextrin. This forms the so-called glucose syrup of trade. If the boiling is conducted in a closed vessel under pressure almost all the starch is converted into dextrose. This product after treatment and evaporated in vacua forms the article of commerce known as grape sugar. The liquid product is alone used as an adulterant of honey. After the formation of glucose the product is neutralized with lime, forming the insoluble calsium sulphate or calsium oxalate which is separated from the liquid. The resulting syrup is boiled to the desired consistency. In Germany potatoes furnish the starch for the manufacture of glucose, but in the United States corn alone is used.

Glucose is only one-half as sweet as cane sugar, possesses a characteristic metallic taste and is miscible in all proportions in water and solutions of other sugars. It does not readily crystallize. It tractably acquires the flavor of the substance with which it is mixed. Its cheapness and general properties make it an excellent adulterant for other sugars. Probably nine-tenths of all adulteration in honey and syrups consist of glucose.

Glucose occurs in nature in combination with other sugars in many fruits and vegetables. An investigation performed at the instance of the U. S. Department of Internal Revenue resulted in finding glucose as made in this country not in the least detrimental to health; in brief, a proper food.

Sucrose, or the sugar of cane and sugar beets, was, before the advent of glucose, much used in the adulteration of honey. It has not altogether gone out of fashion yet.

There are two objections to its use from the fabricator's standpoint:

First. Its cost; being nearly as much as California honey.

Second. Its tendency to crystallize from solution. Cane sugar does not crystallize readily, however, when mixed with 75 per cent of honey.

The use of much less proportion of cane sugar would hardly pay for mixing. If a smaller quantity than 15 per cent is present in honey the sugar was probably fed and elaborated through the organism of the bee.

Invert sugar is made by changing or inverting, by the use of acids or ferments, sucrose into dextrose and levulose. Although neither dextrose or levulose are individually as sweet as sucrose, curiously enough a mixture of the two is said to be sweeter. The optical behavior of pure invert sugar would easily lead to its detection; also the absence of phosphoric acid in the ash. When mixed with honey it can be detected with no certainty.

Water is a very cheap adulterant of honey, but in excess is as patent as a label, and generally affects its market value. In the examination recorded no account was taken of added water.

The samples for this investigation were collected largely in St. Paul and Minneapolis. Usually one sample, consisting of the smallest size tumbler in which extracted honey is marketed, containing about one pound, was taken of each brand. So the percentage of adulteration given represents rather the percentage of adulterated brands than the percentage of adulterated honey sold. The latter is probably higher, as the adulterated honey was usually cheaper or put up with more attractive label, and were first in popular favor. In addition to honey obtained by the inspectors I am indebted to Mr. A. C. Acklin for samples of honey of known purity from his own apiary. These samples, as well as a few others of doubtful purity or peculiar composition, will be recorded in the table of analysis.

That chemists may know how to interpret the analyses the method of analysis is given.

DIRECT POLARIZATION.

28.048, grams sample was taken, dissolved in about 90 C. c. of water, precipitated with 2 C. c. of lead acetate and a few drops of aluminum cream, diluted to 100 C. c. at 17 1-2° C. Dry animal charcoal added, filtered through dry filter and polarized at 20° c.

INDIRECT POLARIZATION.

Method of Wiechmann.

Formula for calculating sucrose:

$$\text{Sucrose} = \frac{100\ S}{142.66} - \tfrac{1}{2}\,T.$$

$S =$ Algebraic sum of direct and indirect polarization.

$\tfrac{1}{2}\,T = 10.$

The polariscope gave with a normal solution of as pure sucrose as could be obtained

Average of 3 readings in 200 m. m. tube, 100.01.

Average of 3 readings in 100 m. m., tube, × 2, 99.9.

REDUCING SUGAR.

A one per cent solution of honey was run into 10 C. c. of boiling standardized Fehling solution until all copper was reduced as indicated by ferro cyanide of potassium. It was noticed that a more sensitive test could be obtained by the use of porous paper than, as the drop test is usually applied, on porcelain. The reducing sugar was calculated as invert sugar.

Of the 51 samples of honey analyzed 33 were found to be pure and 18 adulterated. Thirteen were adulterated with glucose and 5 with cane sugar. All samples of honey shown by optical evidence to contain glucose gave precipitation with alcohol. Honey classified as pure gave a direct polarization of from —3.6 to —19.6. Most samples, however, polarized between —10 and —14. California honey was usually more levorotary than honey produced in this state.

ANALYSES OF HONEY.

	PRODUCER.	Description.	Direct Polarization.	Indirect Polarization.	Sucrose.	Reducing Sugar.	Dextrine.	Water.	How Adulterated.
1	A. C. Acklin	White Clover	—11.3	—14.8	2.64	75.23	......	13.59	.05 Ash.
2	A. C. Acklin	White Clover	—13.4	—14.6	.90	75.23	......	15.27	.036 Ash.
3	Gessner	White Clover	—3.6	—13.6	6.03	68.70	......	17.66	.21 Ash.
4	F. H. Hunt	Very Dark Color.	+89.9	+88.6	1.00	57.10	......	....	Glucose.
5	F. H. Hunt	Very Dark Color	+92.4	+90.4	1.50	55.75	......	....	Glucose.
6	California	Very Dark Color	—15.1	—15.8	.55	75.23	......	....	....
7	....	Dark Color	+21.1	+19.6	1.12	67.70	Yes	....	Glucose.
8	Towle Syrup Co.	....	+44.2	+37.2	5.28	54.48	Yes	....	Glucose.
9	F. H. Hunt	....	+90.2	+87.0	3.75	54.80	......	....	Glucose.
10	F. Moser	....	+13.4	—16.8	22.76	57.11	......	....	*
11	Coulter Mfg. Co.	....	+70.6	+58.4	9.19	55.75	......	....	**
12	Smith & Austrian	....	+16.9	+11.4	4.15	....	Yes	....	Glucose.
13	Frank Moser	Light Amber	+17.2	—20.6	28.50	50.00	......	....	*
14	Wood & Harris	....	+47.1	+40.0	5.35	62.40	Yes	....	Glucose.
15	Phillips & Co., Cal. Honey	....	+25.3	+21.6	2.80	....	Yes	....	Glucose.
16	Frank Moser	Light Yellow	+2.2	....	....	....	......	....	*
17	Frank Moser	Light Yellow	+2.0	....	....	....	......	....	*
18	Wood & Harris	....	....	....	....	....	Yes	....	Glucose.
19	Wood & Harris	....	....	....	....	....	Yes	....	Glucose.
20	No. 333	....	....	....	....	....	Yes	....	Glucose.
21	Anthony Kelly M. Co.	....	....	....	....	....	Yes	....	Glucose.

* Cane Sugar. ** Cane Sugar and Glucose.

Samples of honey manufactured by F. H. Hunt, of Redlands, California, contained the smallest percentage of honey of the samples analyzed. Mr. Hunt, a beekeeper in his native state, brought a carload of honey with him, secured rooms and prestige of Smith & Austrian, commission merchants in St. Paul, and commenced to flood the state with his product. Samples of his honey were taken by the inspectors and its true nature ascertained. The beekeepers' union also took hold of the matter and exposed Mr. Hunt pretty thoroughly in bee journals. (See "Gleanings," vol. xxii., page 62.) Without waiting for the sequel Mr. Hunt packed his grip and departed, leaving some mixed honey in Smith & Austrian's hands to be disposed of.

While most of the California honey handled by Philipps & Co. of Minneapolis was found to be genuine, that handled by J. S. Livington, Minneapolis, was heavily adulterated with glucose. Three samples of honey handled by the above firm were brought to the laboratory by Coville Bros., Minneapolis. One sample, No. 7, was found to be adulterated. The amount and kind of adulteration indicated what subsequent developments proved, that the sample of honey was mixed by the seller to avoid a contract.

Sample No. 8, manufactured by Towle Syrup Co. of St. Paul, shows how this enterprising firm disposes of a part of its glucose.

The bees in the apiary of Mr. Moser departed from the usual custom of bees this spring and yielded a "honey" consisting in large part of sucrose. Nos. 10 and 13 were undoubtedly mixed, while, were it not for the previous record, Nos. 16 and 17 might be classed as abnormal honey, or as honey obtained from bees fed upon sugar and taken from the hive before "matured."

Messrs. Wood & Harris sell two brands of "pure extracted honey." "The Horse Shoe" brand was found to be a mixture of glucose and honey, while the other was unadulterated honey. They claim to have reformed, but a sample of honey put up by them, examined this fall,—No. 318,—does not go far to substantiate the claim.

No. 3, although I have every reason for believing was sold for pure honey, contains more than usual but not abnormal proportion of sugar.

No. 6, although classified as pure honey, has the optical and chemical properties of a mixture of honey and invert sugar. Yet it is not impossible that pure honey should have the same characteristics.

The investigation indirectly throws some light on the parties responsible for adulteration. There is always a tendency to shift responsibility for unpleasant and unlawful acts. The dealer points to the producer, and the producer laments the loose principles of the dealer. As the dairyman claims the watered milk was given by the cow, so the apiarist affirms the bees yielded glucose honey. Some one else is to blame. On this subject Cook says "it is generally thought by beekeepers, and with good reason, that if honey was so extensively adulterated it was the work almost exclusively of the dealers."

The dealer certainly does his share in adulterating honey, but the frequency with which certain brands from beekeepers have been found on the market can only lead to the conclusion that the responsibility for adulteration rests in part, at least, on the producer, and he is the beneficiary of the unlawful profits accruing therefrom. Nevertheless, such work is the exception and not the rule, and is as strongly condemned by the beekeepers' union as mixing by tradesmen. The beekeepers' union is to be congratulated in securing laws against fraud in the sale of honey, thereby making additional demand for the genuine article, and benefiting both the producer and consumer.

PRESERVATIVES.

Almost every article of food, the manufacture or sale of which is regulated by our state law, is liable to contain poisonous preservatives. Milk, butter, eggs, liquors, fruits, canned goods, meat, all have been found to contain chemical antiseptics of a poisonous nature.

As sensitive as are the public in matters touching their pocketbook, they do not so greatly object to being swindled, or to pay the price of a superior article for inferior goods; but every thinking man does object to those forms of deleterious adulteration, depending upon the use of added preservatives. Many will agree with Dr. Hehner, ex-president of the English society of public analysts, who in an address before the society said:

> "We should work for the entire prohibition of all kinds of preservatives. It is time that we went back to natural food. I object to being physicked indiscriminately by persons not qualified to administer medicine whilst I am in health. I object still more when I am ill. I object still more strongly to have my children physicked in their milk or their bread and butter. It is no consolation to me to know that the physic is not immediately fatal, or not even violently injurious. The practice is utterly unjustifiable, except from the point of view of a dealer who wants to make an extra profit, who wants to palm off a stale or ill-prepared article upon the public."

It is the usual order of organic material to decay. Whether it be a beautiful flower or noxious weed, necessary to comfort or injurious to health, valuable as a fuel or food, in time it must yield its elements to the air. In a former age when man's needs were few, and the means of satiation abundant, the necessity for preserving food for any length of time was not as great as at present, when the densely populated and pampered people demand the choicest of food, in season and out of season, whether it grows in their own temperate zone, or in the torrid orient.

As one locality produces food in much larger quantities than is needed for home consumption, it is but natural that the enterprising nineteenth century should find some means to retard decomposition until an exchange of commodities can be made. One of the first facts discovered was that it is not natural for most products in themselves to decompose, but that such decomposition is effected by living organisms, bacteria. To bar their entrance, to retard their growth, or to entirely destroy these bacteria is the aim of the producer. This may be accomplished in a number of ways, many of which are harmless. The methods of food preservation may be classified under four heads:

1. Drying.
2. Exclusion of air.
3. Low temperature.
4. Chemical antiseptics.

There can be no objection to drying or elimination of the major part of the water. This form of preservation is extensively used in fruits, raisins, beef extract, condensed milk, soup, etc. The new method of drying in vacua has greatly enhanced the value of such articles.

The exclusion of air is known to every house wife as one of the best methods of preservation. The effectiveness of this method is perhaps more forcibly shown when the jar of preserves has not been sealed perfectly tight. The success of the process is always dependent upon the destruction of micro-organisms already in the article to be preserved. When applied to alcoholic beverages, this process is called "pasteurization." For want of a better term, the same name has been applied to milk when decomposition is arrested by heat.

Refrigeration is extensively used in keeping all articles of food for a short time. This is one of the most valuable methods, as articles preserved in this way are wholesome and preserve their natural color, form and flavor.

With these harmless methods of preservation, applicable to almost every artice of food, it would seem that no other means would be employed. But there are some defects in the mentioned methods; some are expensive, some will not preserve indefinitely, all are effective only as the conditions are rigidly observed. To overcome these difficulties and also to preserve articles of food too far decomposed to allow of other treatment, chemical agents are added which destroy the micro-organisms and prevent the growth and development of the spores. Among the chemical agents so used may be mentioned alcohol, acetic acid (vinegar), salt, sugar, sulphuric acid, sulphurous acid, salicylic acid, borax, boracic acid, benzoic acid, sodium benzoate, sulphite of potassium and sodium and lime, bisulphite of potassium and sodium and lime, naphthol, saccharin.

Many other chemicals, as arsenic, corrosive sublimate, etc., are excellent antiseptics, but too violently poisonous to be thought of as preservatives for food. The first four named are certainly harmless, but must be used in large quantities to be effective. The consensus of opinion at present is that the remainder are one and all harmful. They are powerful as therapeutic agents, and cannot be inactive in food. If the antiseptics are successful in preventing growth and activity of the micro-organisms in the food, they cannot be inactive towards the digestive fluids whose functions are dependent upon similar ferments. Let me suggest that this class of food preservatives receive a more general condemnation by those concerned in the public health.

The powder "Preservaline" was found to consist largely of sodium benzoate.

A package of the "Great French Preserving Process" was purchased of Bannon & Co., St. Paul, agents, Snodd, Savage & Co., St. Paul. Among the claims made by the manufacturers is that it preserves all kinds of fruit, vegetables and berries in their natural state; no cooking, no sugar, no air tight cans, no acid, no alcohol used. Certain so-called physicians and chemists go on record as claiming that it "contains absolutely nothing injurious to the health of persons eating fruits, etc., preserved by its use," that "there is nothing harmful in its use, but on the contrary the process is conducive to the health where used."

These soft and soothing words undoubtedly mislead many people.

The manager of Wildwood writes the agents that he wishes to be supplied with 100 cases of strawberries, etc., put up by the great French preserving process.

The "process" depends for its effectiveness upon the powerful agent sulphurous acid. The power is simply a mixture of sulphur, charcoal and saltpetre, the ingredients of gunpowder. Instead of mixing the ingredients in the proportion to form an explosive mixture, they are mixed so that the sulphur may burn slowly, forming sulphurous anhydride, which is absorbed by the water forming sulphurous acid. The preservative it may suffice to say will perform its work perfectly, except that it is a great bleaching agent, and destroys the color of the fruit. Its use is entirely prohibited in most of the countries of Europe.

EXTENT OF FOOD ADULTERATION.

It must not be supposed that the food products heretofore mentioned are the only ones adulterated. Indeed, almost every article we eat or drink has been or is now subject to adulteration.

Tea and coffee, perhaps, head the list of adulterated beverages, yet liquors, cocoa and cider are by no means free from sophistication. As the result of extensive analyses in this and other states it has been shown that canned goods, spices, preserves, jellies and jams are especially liable to contain adulteration—sometimes premeditated, sometimes accidental. It is true that many adulterated articles are as harmless as the article for which they are substituted,—the adulterant being added either to improve the looks of an inferior article or to dilute the commodity, thereby deceiving the public. Yet some forms of intentional adulteration, as the facing of teas, the coloring of canned goods, candies and coffee, and the use of preservatives are actually injurious to health.

This class of food adulteration has not received attention commensurate with its importance from the public, the legislators, or possibly the officials intrusted with the enforcement of the laws of the various states.

Respectfully submitted,
E. N. EATON,
Chemist State Dairy and Food Commission.

CHEESE FACTORIES.

Hon. Berndt Anderson, Dairy and Food Commissioner:

I herewith report the work done in the cheese factories of the state by myself, which will give those interested an idea of the importance of this branch of dairying:

During the past two years I have inspected milk and cheese in about 200 cheese factories and creameries. I have tested each sample of milk by the Babcock test, having made in all about 2,500 tests. The result of my inspection in the various factories was carefully noted, and a full report of each day's work sent to the secretary of the department. When desired, instruction was given to cheese makers and also to patrons regarding the care of milk. In comparison with other years, a marked improvement was found in the quality of cheese. The largest percentage of cheese produced in this state is made on the Cheddar plan, which I will consider further on in this report.

It is a satisfaction to report that we do not, as formerly, come in contact with the soft, spongy, ill-flavored and generally bad appearing cheese. That is not the kind of cheese which our factories are engaged in making. My duties have also called me to the inspection of milk which is sold in towns throughout the state. The milk delivered at cheese factories I found generally to be above the standard. There were instances where suspicion rested pretty heavily, and in those cases the samples were sent to the department for chemical analysis. In my special line of work as cheese inspector, I also visited grocery stores and examined cheese kept by grocerymen for sale. If I had reason to doubt the quality of cheese kept by them, I at once secured samples and sent them in to the department for analysis.

Another matter which ought not here to go unnoticed was the fact that all milk delivered at stations to be shipped to the cities was also inspected. Many letters, coming from factory men wishing to employ butter or cheesemakers, I have received and answered. Also letters coming from butter and cheesemakers who were seeking employment. They each received the same considerate and courteous attention. As an index of the work which is being carried on, and to show the magnitude of the cheese industry which is, I am glad to say, constantly growing, I here append a list of the cheese factories of the state with such data as I consider of interest and importance to the readers of this report.

Many of the factories in the state have not yet closed up their season's work. Therefore, from these factories reports could not at this time be obtained. There were others just closing, but owing to other matters pressing them, their reports could not be secured in time to be placed in the list before this report went to press. From the following report and other reliable information, I calculate the total amount of cheese produced during the past two years in Minnesota to be approximately 4,000,000 lbs.

The man who is to make a success of the production of cheese need not content himself with the thought that he is traveling a royal road. By no means can he sit down in sloth and idleness and court prosperity. She is one of those wily elfs that must be won over by toil, skill, patience and economy. It is largely experimental work in which the cheesemaker is engaged. Each day he may find new conditions, and it is his business to meet these conditions, to study them and to overcome them. If he does not, he sooner or later finds that he has a "soft" cheese, a "spongy" cheese, a "hard" cheese, or, perhaps worst of all, an ill-flavored cheese which nobody wants at any price.

At this point I wish to emphasize some facts regarding the making and curing of cheese; facts I have gained only by close observation and a practical experience in field and factory covering a period of over twenty-five years. As milk is the foundation of all cheese, the quality of the cheese cannot be good unless the milk is good. It should be rich milk. Four per cent of fat, five per cent, or even six per cent, is none too good for cheese. It is claimed by some who desire a half cream or a skim cheese, that all the butter fat above four per cent is lost in the whey. Experiments and facts do not bear out these assertions. Take New York for an example. The experiments at the New York Experiment Station are interesting. These experiments showed that the actual amount as well as the proportion of milk fat lost in the whey increased gradually, but not uniformly when the amount of fat in the milk increased, but while it was true that the loss of the fat increased both absolutely and relatively, when the amount of fat in the milk increased, it was not true that all the additional fat above four per cent, or even about five and one-half per cent was lost in the whey. Results similar to those just stated have been obtained with cheese at our own experiment station.

Now let us return to the milk. The receiving of the milk at the factory is an item of prime importance. The utmost care should be exercised in the receiving of milk. These are some of the essential points to be considered:

In the first place if you have sour milk or over-ripe milk, it means fast heating. Second, this sudden heating requires quick handling of the curd to get an even distribution of heat throughout the entire mass while scalding to the right temperature. The factory man should insist on his patrons exercising the utmost care with their milk. It is always better for the maker to ripen his own milk to the proper degree of acidity. Another point to be considered: The maker should examine all cans, covers and skims in cans once or twice a week to thoroughly satisfy himself that all patrons keep their cans properly cleansed. As a reminder to both the maker and patron I wish here to repeat what Prof. James Robertson of Canada has already said. When a man in a cheese factory has a can all greasy inside and all spattered outside, he is not ready to seek skill. He is going to contaminate the milk, and skill and contamination won't go into partnership in the dairy business. So my advice to the patrons is to see that as soon as the cans are brought home, they are at once emptied and washed with warm water and sufficiently aired during the day to keep sweet.

Throughout the United States and Canada where the Cheddar, or the "stirred curd" cheese, is made, there is but little variation in the process of making. In the manufacture of the above varieties the milk is generally heated to a temperature of about 85 degrees Fahr., a slightly higher or lower temperature used according to the judgment of the maker, as peculiar conditions may demand. The ripening is an essential feature, and for the purpose of obtaining the desired degree of acidity, various tests are brought into requisition. The principal ones being the Boyd test, the Monrad and the system quite generally used throughout Canada known as the cup test. The latter is a good practical test for the degree of acidity or ripeness for cheese making.

The method is applied in the following manner: After the vat of milk has been heated to the desired temperature, take eight ounces of milk from the vat, a tea cup or some small dish to manipulate the test in and one drachm of rennet extract of known strength diluted with a drachm of water just before adding the rennet, take your watch in one hand and a tea spoon containing the rennet in the other and when the second hand of your watch comes to some known number drop the rennet into the vessel, thoroughly stirring with a rotary motion for 10 to 12 seconds. To be able to tell for a certainty when the milk in the cup has begun to coagulate put a small piece of burnt match or scale board, or something that will float, in the cup or vessel just before the rennet extract is added. By constant stirring, the black speck is put in motion with the milk; when it suddenly stops the milk has begun to coagulate. If the milk coagulates in from 25 to 30 seconds it is ready to set. The exact degree of ripeness is something hard to determine, but the intuition of the skilled cheese maker enables him to tell the proper point. It is generally understood that the object in the ripening of the milk before adding the rennet is to render the action of the rennet more rapid. There is little doubt but that the ripening has some other influence. The bacteria, for instance, thus added in the form of a "starter," tends to develop in the cheese a high flavor, similar to that of ripening cream for butter. There are many things regarding the influence the ripening of milk has upon the process of cheese making or upon the finished product, which we do not yet fully understand. This fact we are aware of: The rennet may cause the milk if properly ripened to coagulate in 10 or 20 minutes, whereas, if added to milk that has not been ripened, the rennet may not cause proper thickening of the milk short of two hours. Another important fact to be considered in the making of cheese. The judgment of the cheese maker must be called into action in order to determine when the curd is firm enough to cut and yet not too firm.

The next step, as soon as the curd is sufficiently cut, is to stir very gently for 10 or 15 minutes until the outside of the pieces of curd show the appearance of a slight film and the whey commences to separate freely from the curd. The curd is then heated gradually to a temperature of about 98 degrees F. The rapidity of heating and the extent of heating are points which the judgment of the maker can alone determine. During the heating the curd is kept in constant but gentle agitation. This heating causes each piece of curd to shrink and expel moisture whereby it becomes more firm and dry. Relative to the details of this shrinking and drying action, much remains to be learned, but it is probably due to the combined action of heat, of rennet and of lactic acid. After the temperature has reached about 97 degrees F. the heating is discontinued and the curd is stirred only at intervals sufficient to prevent its packing on the bottom of the vat. When the curd has become sufficiently firm and dry, it is allowed to settle and the whey is drawn off. To tell exactly when is the proper time to draw the whey from the curd requires the very best judgment of the maker, for this is one of the most critical points in the manufacturing of cheese. Here must be brought into requisition the cultivated sense of smell, touch, taste and sight.

For the hot iron test take a piece of iron about two feet long, heat it hot but not enough to scorch the curd. Take a handful of curd from the vat, squeeze out the whey, press it against the iron, and if it adheres to it and on removing strings out in fine threads like hairs, the acid is developed, and all whey should be removed, The curd should be allowed to stay in the whey until it will string on the hot iron from one-eighth to one-fourth of an inch. The maker should be careful not to allow too much acid to develop in the vat before the whey is removed.

While we have a variety of cheese made in this state, of which I may here mention Cheddar, Stilton, "stirred curd," Neufchatel, Sage, Switzer, Brick and Pineapple, I will notice in particular the Cheddar. It is a popular cheese and made on this plan: After-the whey has been drained from the curd, the curd is packed on opposite sides of the vat, leaving a space in the centre to enable the whey to drain off more readily. After a time the curd becomes packed or matted and is cut in pieces to such size as may be convenient to handle. These pieces are turned over from time to time to allow the whey to drain more rapidly. When the curd has become pretty well freed from whey, the pieces are doubled, and the process of doubling is continued at short intervals until the whole forms a compact pile. It is then held at a certain temperature until it assumes a certain condition which the eyes and also the touch of the skilled maker can detect. The curd is then turned up, spread out and cooled at about 85 degrees F. It is now ready to run through the curd mill. After being cut completely, the curd is salted and put to press. From time to time our attention is called to certain rules and regulations laid down by those who are supposed to be authority on the making, curing and handling of cheese. A few of these rules are essential and no cheese maker can afford to ignore that which brings success to his calling. It is with this object in view that I have reproduced some of the excellent suggestions offered by Prof. James W. Robertson, dairy commissioner of Canada: The notes which refer particularly to the opening of the spring's work, which usually begins in May, are to the point and as follows: If there be a leakage anywhere from the floors, spout or tanks, which is not immediately preventable, provision should be made for the drainage of the waste if only by shallow open trenches. A liberal supply of lime and gypsum should be spread around such places. Don't fail to secure a barrel or two of each for use during hot weather. If the factory buildings are not painted and will not be painted get them whitewashed this month. Make the surroundings of the factory neat and tidy. Plant a few trees. While keeping the outside of the premises as creditable to your tastes and neat habits as possible, make the inside to reflect still more your aversion to everything untidy and dirty. Give every part of the factory a thorough cleaning and keep it in a sweet state all summer.

Before the curing room contains any cheese, fumigate it by burning some sulphur mixed in alcohol. That will help to prevent the growth of mould on the outside of the cheese. Be sure that the making room floor is so well constructed and supported that it will not shake or vibrate during the coagulation of the milk. There are other points about a factory which no cheese maker can afford to overlook. For instance, the hoops should be evenly filled so as to have the cheese of uniform size. Light pressure should be applied at first, gradually increasing it every ten minutes for from half to three-quarters of an hour, allowing the cheese to gradually knit together, which will give a closer body than if hard pressure is applied at once. After proper pressing, the cheese should be taken out, the bandages should be pulled up carefully and neatly folded over the ends, allowing about one inch to lap over the ends, then put to press again and more pressure applied. The last thing at night, apply all the pressure you can; then in the morning, the first thing apply still more. Do not think that when your cheese is taken out of the press that the work is all done. The ripening process must now begin, and one of the principal things is to keep an even temperature in the curing room. The peculiar mellow appearance and fine texture of good cheese may be, and is due to a certain extent, to the butter fat, nevertheless, these qualities largely depend in a much greater degree upon a gradual change to which the casein is subjected in ripening.

A cheese that is properly made with uniform ripening will, other things being equal, have that rich oily body, also that peculiar flavor so much desired and appreciated by the masses who eat cheese. Everything in the curing room should be in perfect order. See to it that the cheese be carefully rubbed and turned on the shelves every day. If, when put in the curing room the head cloths are not left on, they should be immediately greased with hot grease to prevent them from cracking. In preparing cheese for market they should be carefully weighed and boxed, using scale boards on each end, and the weights should be plainly marked on the box. Boxes should be shaved down within a quarter of an inch of the cheese.

When we take into consideration the superior advantages which we, as a cheese producing state possess, there is no reason for being in the least discouraged. Our climate is excellent for stock; we have the best of grasses, and are able to produce any kind of forage necessary. No state in the Union has a purer or better water supply, and the dairymen are fast improving their breeds and their herds of dairy cows. In the enactment of proper laws for the encouragement of the dairymen and the farmer, and for the protection of the consumer, no state has gone farther or been more jealous of the rights of her citizens. The wisdom of having a standard fixed by our legislature for cheese none will attempt to dispute. Many states desire a law similar to ours, but their efforts thus far in that direction have not proved successful. In their report of 1892 the Massachusetts State Board of Health pointed out the advantage to be gained by having a state standard for cheese, but their state has not yet succeeded in enacting a law of that character.

With all the advantages bequeathed us by nature; the enactment of good dairy laws; the strenuous efforts made for the enforcement of those laws, and the fact that at the dairy exhibit at the Peter Cooper institute in 1875 Minnesota carried away the prizes, still we have to deplore the fact that at our Columbian exhibition in 1893 Minnesota had practically no part nor lot in the way of exhibiting her great and growing cheese industry.

What were we doing, that we should have let slip this grand opportunity of our lives never to come again, perhaps, to show to the world our resources as a cheese producing state?

By referring to the table the reader will notice the names of the various cheese factories in the state, the location, the capacity, the percentage of fat the milk contained when inspected, the name of the proprietor or manager. These data required time to collect, and many of the factories I have visited twice or three times during the course of the season. The season of 1893 was, generally speaking, much better than the season of 1894. This was largely due to the fact that the severe drouth of 1894 materially affected all branches of dairying:

NAME OF FACTORIES AND POSTOFFICE.	PROPRIETOR OR MANAGER.	No. of Months Operated.	Daily Capacity. Lbs.	Average per Cent of Fat.
Berne Factory, Berne	Crescent Creamery Co.	6	15,000	3.32
Pine Island, Pine Island	Crescent Creamery Co.	6	15,000	3.53
County Line, Alma City	E. A. Comstock	5	5,000	3.72
Wilder, Wilder	W. S. Trowbridge	....	....	3.53
Bergen, Bergen	S. J. Skove	3	2,000	3.55
Storden, Storden	Frank Tripp	5	3,000	3.45
St. Michaels, St. Michaels	Michaels & Holzman	6	5,000	3.73
Sauk Centre, Sauk Centre	A. Miller	....	....	3.92
Fergus Falls, Fergus Falls	W. L. Chappell	9	10,000	3.72
Western, Western	T. B. Roberts	6	5,000	3.82
Havana, Havana	L. A. Disbrow	4	10,000	3.55
Turtle Creek, Austin	A. P. McBride	8	5,000	3.46
West Concord, West Concord	Frank Bailey	6	5,000	3.44
Byron, Byron	Crescent Creamery Co.	6	15,000	3.64
Olmsted, Olmsted	Crescent Creamery Co.	6	15,000	3.47
Rock Dell, Rock Dell	Marcus Wing	8	12,000	3.58
Pine Island, Pine Island	Crescent Creamery Co.	6	15,000	3.59
Berne, Berne	Crescent Creamery Co.	6	15,000	3.40
Pleasant Valley, Roscoe	K. Stuckey	5	2,000	4.26
Stanton, Stanton	E. O. Imberg	8	15,000	3.44
Hampton, Hampton	Jno. Delfield	6	5,000	3.55
St. Michaels, St. Michaels	Michaels & Holzman	3	3,000	3.65
Eureka, St. Michaels	E. D. Washburn	6	5,000	3.66
Hanover, Hanover	Michaels & Holzman	4	4,000	3.68
Elm Grove, St. Michaels	Michaels & Holzman	4	4,000	3.89
Lansing, Lansing	H. M. McIntyre	6	5,000	3.61
New Richland, New Richland	Henry Jackming	6	10,000	3.60
County Line, Alma City	E. A. Comstock	3	5,000	3.85
Lake Crystal, Lake Crystal	Geo. V. Norman	4	2,000	3.94
Good Thunder, Good Thunder	Sohre & Henkel	8	5,000	3.81
New Rome, Gaylord	G. Monthy	4	5,000	3.56
N. Redwood, Redwood Falls	Chas. Fleischer	5	5,000	3.73

NAME OF FACTORIES AND POSTOFFICE.	PROPRIETOR OR MANAGER.	No. of Months Operated.	Daily Capacity. Lbs.	Average per Cent. of Fat.
Sumpter, Sumpter	C. E. Barnum	12	10,000	3.54
Eagle Lake, Eagle Lake	S. V. Perry	2	3,000	3.76
Hector, Hector	A. A. Helstad	6	5,000	4.06
Cedar Mills, Cedar Mills	G. Welch	8	10,000	3.75
Acoma, Acoma	C. G. McEwin	8	10,000	4.00
Biscay, Biscay	F. Albright	8	15,000	3.76
Villard, Villard	C. B. Butler	4	5,000	3.86
Fergus Falls, Fergus Falls	W. L. Chappell	9	10,000	3.50
Western, Western	T. B. Roberts	6	5,000	3.96
New Richland, New Richland	Henry Jackning	6	10,000	3.43
Willmar, Willmar	H. A. Blood	7	5,000	3.87
Union Hill, Union Hill	M. T. Schmitz	3	3,000	4.79
New Market, New Market	Jno. Remitzer	6	5,000	3.56
Medford, Medford	Crescent Creamery Co.	8	15,000	3.66
Oakland, Oakland	W. Willson	6	5,000	3.62
Minnesota Lake, Minnesota Lake	P. F. Wendt	6	5,000	3.61
Willmar, Willmar	F. P. Dahl	7	5,000	3.86
Armour, Johnson	F. J. Johnson	3	2,000	.....
Western, Western	T. B. Roberts	6	2,500	3.70
Verndale, Verndale	W. W. Pike	6	2,500	3.49
Minneota, Minneota	K. Broughton	2	2,000	.....
New Rome, New Rome	T. H. Becker	4	5,000	3.69
Acoma, Acoma	G. C. McLenen	12	5,000	3.71
Glencoe, Glencoe	S. M. Gazin	....	2,000	.....
Hutchinson, Hutchinson	H. M. Smith	....	3,000	.....
Hector, Hector	T. F. Miller	5	5,000	3.70
Sumpter, Sumpter	C. Barnum	12	10,000	3.70
Biscay, Biscay	J. F. Albright	7	10,000	3.97
Blooming Grove, Morristown	F. R. Udell	5	5,000	.....
Morristown, Morristown	A. E. Jones	6	2,000	3.84
St. Michaels, St. Michaels Station	E. D. Washburn	7	5,000	4.22
Cedar Mills, Cedar Mills	Geo. Wells	6	5,000	.....
Rock Dell, Rock Dell	Marcus Wing	8	10,000	3.90
Olmsted, Rochester	Crescent Creamery	7	10,000	3.96
Austin, Austin	A. P. McBride	8	10,000	3.45
Oakland, Oakland	John Turnbull	7	10,000	3.56
Lansing, Lansing	F. Schuette	6	10,000	3.80
Myrtle, Myrtle	W. W. Gast	7	5,000	3.53
Medford, Medford	Crescent Creamery	6	10,000	3.57
New Trier, New Trier	N. P. Goss	7	10,000	3.40
Stanton, Stanton	F. Goudy	8	10,000	3.43
West Concord, West Concord	P. J. Norton	6	5,000	3.55
New Richland, New Richland	H. Jaehning	6	10,000	3.56
Minnesota Lake, Minnesota Lake	P. F. Wendt	5	5,000	4.19
Good Thunder, Good Thunder	Sahre & Henkel	9	10,000	3.56
Lake Crystal, Lake Crystal	Geo. W. Norman	5	5,000	4.00
Garden City, Garden City	Blanchard & Son	5	2,000	3.73
New Market, New Market	Rentzes & Co.	6	5,000	3.64
Willmar, Willmar	Willmar Creamery Co.	8	5,000	3.67
Elbow Lake, Elbow Lake	J. B. Skograns	8	5,000	4.04
Park Region, Fergus Falls	W. L. Chappell	8	10,000	3.55

FILLED CHEESE.

If space would permit several pages of this report might profitably be used in the discussion of this interesting subject, "Filled Cheese." I will content myself, however, by giving some of the most entertaining features of this delectable eatable when discovered, how made, etc.

Hardly more, then a decade has passed since the discovery of the art of making "filled" cheese, and prior to that we had skim cheese, poorly made cheese and all sorts of cheese, but soon after the introduction oleomargarine into this country came the filled or bogus cheese. At first the cream was abstracted from the milk, and by a peculiar process to which the reader's attention is called further on in this report, the mixing of refuse butter with the skim milk was successfully carried on. The large per cent of casein disguises the off flavor of the butter, and hundreds of these cheese were sold to unsuspecting dealers and to consumers as genuine full cream cheese. That was not all. When it came to a test and they were placed in the hands of the chemist, he too was many times baffled and could not tell which was the false and which the true. Finally, war on spurious butter-filled cheese was waged so fearfully, that the makers of these cheese went out of business, or sought other ingredients, which were in the shape of neutral oil and cotton seed oil. This kind of filled cheese is still made, and finds a market where ever the goods can be sold in a clandestine way. Mr. H. C. Thom, formerly dairy and food commissioner of Wisconsin in 1889, commenced an active campaign against the manufacturers who were flooding the market with filled cheese. In describing one of these factories, which Commissioner Thom visited, he said:

> Four separators were running and the cream was rapidly extracted. The milk was run into a large vat. About one pound of butter was added to a hundred pounds of milk by the following process: Forty or fifty pounds of butter was put into a sheet iron can. The can was set in a barrel and the cover placed on the barrel. A steam pipe was inserted and the butter melted. It was then poured into a half-barrel of skimmed milk and heated to 160 degrees, Fh., and then run into the large vat of milk. A large amount of rennet was introduced and the whole was coagulated before the foreign compound had time to rise.
>
> I made a close examination of the butter used and took samples of it which are in the office at this writing. It is well for the manufacturers that the people who eat the cheese are ignorant what they are putting into their stomachs. All indications went to show that the butter had been bought by country grocers, in small lots, and had spoiled on their hands. Yellow butter, white butter, gray butter, black butter, green butter, all colors, stinking, rotten butter, were dumped into tubs, pails and shoe boxes and held through the hot summer days for these men to buy. The employes stated that the butter was picked up wherever it could be obtained.
>
> I have been in rendering establishments and soap factories, but it has never been my misfortune to meet a smell that compared with the smell that came from that barrel of steaming grease. It was with difficulty that I could make my stomach hold its own while I took a sample. The manufacturers make no effort to clarify or deodorize or refine or purify, simply get it to run well and then introduce it to innocent milk and afterward to innocent cheese eaters.

This spurious article, "filled cheese," not only did great damage here at home, but seriously affected trade abroad. A large export trade was being built up and foreign dealers in cheese became seriously alarmed at the situation. The sale of "filled cheese" had reached that point where the Liverpool Provision Trade Association and Exchange Company, through their secretary, appealed to our United States consul for relief from this iniquitous traffic. I here give the communication of the secretary of the association to our American consul, Mr. Thomas H. Sherman, in full:

> Liverpool, Jan. 8, 1890.
>
> Dear Sir:—The directors of this association respectfully wish to draw the attention of the government to the exportation from the United States to the United Kingdom of what is termed "filled cheese." This article is a compound of skim-milk and grease, such as old butter, oleomargarine, or lard, the favorite ingredient being at present stale butter, on account of the belief of the manufacturers that they can thus defy the analyst. My directors believe that this product is exceedingly harmful to the dairy farmers of your country. It is not the natural product of the cow, known as cheese. It is a well known fact that for the past five years, since this fraud has been practiced, the price of pure cheese, instead of advancing in the spring months, has steadily de-

clined. This product is neither wholesome nor palatable, but is injurious to the American cheese trade, as it curtails consumption of the pure article, disgusting the community with American cheese as an article of food.

We believe the true remedy lies in prohibiting the production of filled cheese, which is manufactured in the western states, chiefly in Ohio, Illinois and Wisconsin. We are informed that New York State has prohibited its production. We ask you for your assistance in this matter, and trust you will not only put this matter in the hands of the government, but suggest that they should draw the attention of the dairy associations and governors of the various states where this article is produced.

Your obedient servant,

J. L. HARMOOD BANNER, Secretary.

This document was designed to reach the New York produce exchange, but it had to run the red-tape gauntlet, through four departments of the government before reaching its destination. After reaching the produce exchange, that body took action, and also quoted the opinions of several food and dairy commissioners.

During the past summer representative business men from England and Canada have visited the United States for the purpose of securing co-operation among our manufacturers and dealers to rid the markets of "filled cheese." Mr. Alex W. Grant of Montreal, Canada, and James L. Grant of Liverpool, England, visited the Utica (N. Y.) Board of Trade, and, says The Dairy World, "expressed themselves in strong denunciation of lard or "filled" cheese, thousands of boxes of which they said were being exported from the west to England where they did an infinite amount of harm to the American full cream cheese in that country." Thus the beauty of this business is being daily exemplified, and a remedy for the evil should speedily be had, else our honest manufactures of full cream cheese will be driven from the markets.

Milk taken to cheese factories, as a rule, is not tested. Cheese factory patrons pool their milk in the co-operative factories; therefore milk is not bought on the test plan. Creameries buy their milk for their patrons, paying therefor according to the value of the milk as reckoned in percentage of butter fat.

A word of explanation may be necessary regarding the seizure of certain lots of filled cheese that were found in different places in the state. We discovered that the article was being sold in St. Paul, Minneapolis, Stillwater, Mankato, Rochester and many other towns in this state. As a result of our investigation seizures of the spurious articles were made. It was the intention of the department to begin active prosecution all along the line. Commissioner Anderson, seeing that it would be a serious conflict and be the cause of considerable loss to many innocent and unsuspecting people, ordered the cheese returned in most instances with the understanding that it be shipped at once to the manufacturers who were outside of the state. And in no case were the parties released from the charge of selling or having in their possession for sale filled cheese until the requirements of the department were complied with. The cheese was to be shipped back to the manufacturer; the dealer was to certify to the shipment, and in each and every case, a bill of lading from the railroad company was to accompany their statement. By this means our market soon became free of this spurious article.

Respectfully submitted,

E. B. WILLIAMS.

INDEX TO DAIRY AND FOOD COMMISSIONER'S REPORT.

- **Anderson, Berndt, Report of**.......... 2–48
  - Minnesota dairy commission... 2
  - Financial statement.......... 5
  - Report upon milk.......... 5, 6
  - Pasteurization of milk.......... 6
  - Amount of milk inspected..... 7
  - Average standard of milk...... 7
  - Milk standard of other states.. 8
  - Prosecutions.......... 8–10
  - Oleomargarine.......... 10
  - Oleo case of Fred Weideman... 15
  - Oleo case of Armour Packing Co.......... 12–14
  - Oleo prosecutions.......... 16, 17
  - Oleo seizures.......... 17–21
  - Lard.......... 21–23
  - Cottolene.......... 22
  - Baking powders.......... 23–25
  - Baking powders comparative table.......... 25
  - List of alum baking powders. 25–28
  - Vinegar.......... 28–30
  - Vinegar, poisoned vinegar...... 29
  - Inspection of stabl's and cows. 30–48
- Eaton, E. N., chemist, report of... 63–130
  - Percentage of adulteration..... 64
  - Resume of analysis.......... 64
  - Milk.......... 65
  - Quality of milk supply.......... 65
  - Citric acid in milk.......... 65
  - Amyloid bodies in milk.......... 65
  - Phosphates in milk.......... 65
  - Sulphur in milk.......... 66
  - Nuclein, contents of.......... 66
  - Proteids of milk.......... 60
  - Fibrin in milk.......... 66
  - Amphioteric reaction.......... 66
  - Lactic acid in milk.......... 67
  - Fat globules of milk.......... 67
  - Effects of food.......... 68
  - Effect of care of the cow.......... 68
  - Babcock test.......... 69
  - Composite sample.......... 69
  - Acid measure.......... 69
  - Sanitary relations of milk...... 69
  - Germ contents.......... 70
  - Bitter milk.......... 70
  - Soapy milk.......... 70
  - Anthrox bacilli.......... 70
  - Diphtheria bacilli.......... 70
  - Attenuated virus.......... 70
  - Tuberculosis.......... 70
  - Koch's lymph.......... 70
  - Eradicatiom of bovine tuberculosis.......... 72
  - Sterilization.......... 72
  - Pasteurization.......... 72
  - Adulteration.......... 74
  - Separation of cream during delivery.......... 74
  - Table of milk analysis.......... 75
  - Cream.......... 76
- Eaton, E. N., chemist, report of... 63–130
  - Analysis of cream.......... 77
  - Evaporated cream.......... 77
  - Condensed milk.......... 77
  - Progress in butter making..... 77
  - Pure cultures of flavoring bacteria.......... 78
  - Proximate composition of butter.......... 78
  - Description of terms.......... 79
  - Composition of butter fat....... 79
  - Limits in proximate ingredients.......... 79
  - Variation in composition of butter.......... 80
  - Influence of foods.......... 80
  - Adulterated butter.......... 80
  - Composition of oleomargarine 81
  - Healthfulness and unwholesomeness.......... 81
  - Details of manufacture of oleomargarine.......... 82
  - Digestibility of oleomargarine 83
  - Coefficient of digestion.......... 83
  - Color of oleomargarine.......... 83
  - Pink coloring compounds...... 83
  - Patent butter.......... 83
  - Table of analysis of illegal butter.......... 84
  - Analysis of World's Fair premium butter.......... 84
  - Table of analyses.......... 86
  - Conclusions.......... 86
  - Minnesota state full cream cheese.......... 86
  - Loss of fat in manufacture...... 87
  - Discussion of state standard... 87
  - Calculated per cent of fats in cheese.......... 88
  - Fat found in cheese upon analysis.......... 88
  - Cheese made in Minnesota..... 89
  - Recommendations.......... 89
  - Skimmed cheese.......... 91
  - Filled cheese.......... 91
  - Methods of manufacture...... 91, 92
  - Properties of filled cheese...... 92
  - Filled brick cheese.......... 92
  - Chemical examination of cheese for foreign fats.......... 93
  - Table of skimmed cheese....... 93
  - Table of filled cheese.......... 94
  - Technical discussion of method 94
  - Definition of lard.......... 96
  - Grades of lard.......... 96
  - Compound lard.......... 97
  - Substitute for lard.......... 97
  - Constitution of lard.......... 97
  - Silver nitrate (Bechi's) test... 97–99
  - Crystallization of lard.......... 97
  - Ether washed deposit.......... 98
  - Iodine absorption.......... 98

INDEX.

- Eaton, E. N., chemist, report of .63–130
  - Report of inspection and analysis........ 98
  - Analysis table of adulterated lard........ 100
  - Definition of vinegar........ 102
  - Improvement in manufacture. 102
  - Technology of manufacture... 102
  - Hydrolosis of starch........ 102
  - Formation of alcohol........ 103
  - Secondary products of fermentation........ 103
  - Distillation of vinegar........ 103
  - Acetification of vinegar........ 104
  - Loss during acetification........ 105
  - Reduction of proteids........ 105
  - Properties of low wine vinegar 106
  - Dietary value of low wine vinegar........ 106
  - Colored low wine vinegar........ 106
  - Malt vinegar........ 107
  - Beer vinegar........ 107
  - Cider vinegar........ 107
  - State requirements for cider vinegar........ 107
  - Solids of cider vinegar........ 108
  - Red and white wine vinegars.. 108
  - Crab apple vinegar........ 108
  - Berry vinegar........ 108
  - Beet vinegar........ 108
  - Honey vinegar........ 108
  - Glucose vinegar........ 108
  - Pyrologneous or wood vinegar........ 108
  - Adulteration of vinegar........ 108
  - Antiseptics........ 108
  - Vinegar eels........ 108
  - Sulphuric acid in vinegar........ 109
  - Mineral acids in vinegar........ 109
  - Mineral salts in vinegar........ 109
  - Arsenic in vinegar........ 109
  - Salt in vinegar........ 109
  - Misrepresentation........ 110
  - Dilution of vinegar........ 110
  - Illegal vinegar—table........ 111
  - Suggestions to vinegar producers........ 113
  - Loss in manufacture........ 113
  - Twitchell's test (illustrated).. 114
  - Volumetric process apparatus required........114–116
  - Purchase of cider stock and cider syrup........ 116
  - Baking powder, legal requirements........ 117
  - Classification of baking powders........ 117
  - Cream of tartar powders........ 117
  - Misrepresentation of baking powders........ 118
  - Perfect powder........ 118
  - Theoretical yield of gas........ 118
  - Residue in bread........ 118
  - Phosphate powders........ 119
  - Alum powders........ 119
  - Alum phosphate powder........ 119
- Eaton, E. N., chemist, report of...63–130
  - Analyses—table........ 121
  - Honey — percentage of adulteration........ 121
  - Honey producers deceived........ 122
  - History of adulteration........ 122
  - Artificial honey comb........ 122
  - Physical properties of honey... 123
  - Chemical properties of honey.. 123
  - Physiological process........ 123
  - Honey dew honey........ 123
  - Characteristics of honey dew honey........ 123
  - Feed bees cane sugar........ 123
  - Granulation of honey........ 124
  - Adulteration of honey........ 124
  - Glucose........ 124
  - Sucrose (cane sugar)........ 124
  - Invert sugar........ 125
  - Honey sold in Minnesota........ 125
  - Percentage of adulteration........ 126
  - Adulterated honey—table........ 126
  - Preservatives, prevalence of... 128
  - Natural food (quotation)........ 128
  - Necessity of preservative........ 128
  - Preservaline........ 129
  - Extent of food adulteration... 130
- Graham, E. J., asst. commissioner, report of........49–63
  - List of creameries........ 50
  - Creameries of Minnesota........ 53
  - Model factories........ 55
  - Tests of separators........ 57
  - Dairy school........ 57
  - Value of milk........ 58
  - Babcock test........ 58
  - Adjusting dividends........ 59
  - Separators........ 59
  - Butter maker........ 60
  - Sunday operating........ 60
  - Exhibiting products........ 61
  - Organizing co-operative creameries........ 61
  - Skimming stations........ 61
  - Creameries in Freeborn and Steele counties........ 61
  - Overproduction of butter........ 62
  - Butter made in Minnesota in 1894........ 62
  - Our dairy interests........ 62
- Williams, E. B., inspector, report of 130–139
  - List of cheese factories......136–137
  - Filled cheese........137, 138
  - List of seizures of filled cheese 94

ERRATTA.

Page 115, omit 16 cc pipette.

Page 115, omit "Seter," read Leter.

Page 106, 15th line, "one" per cent read one-tenth per cent.

Page 118, "of the present year" read 1893.

Page 100, 101, heading of table, read "Adulterated Lard."

Page 100, reverse order of the last three manufacturers names.

REPORT

OF THE

DAIRY COMMISSIONER

OF THE

STATE OF NEW JERSEY,

1888.

◆

TRENTON, N. J.:
THE JOHN L. MURPHY PUBLISHING CO.
1889.

REPORT OF THE DAIRY COMMISSIONER.

To the Senate and General Assembly:

In accordance with the requirements of Section 15 of "An act to prevent deception in the sale of oleomargarine, butterine or any imitation of dairy products, and to preserve the public health," approved March 22d, 1886, I have the honor to present my third report.

As was stated in a former report, in addition to the duties imposed by the above-mentioned act, I am required to enforce the provisions of "An act to prevent the adulteration and to regulate the sale of milk," approved March 14th, 1882, and also to aid the State Board of Health in the enforcement of "An act to prevent the adulteration of food or drugs," approved March 25th, 1881. The intention of the Legislature, as evidenced by the consolidation of these laws, was undoubtedly to bring under the care of one official all acts of a similar nature. Adhering to the custom followed heretofore, and for purposes of completeness, I have separated the account of work done under the several laws, and have grouped together, under distinct heads, all details relating to special inspection and the results therefrom obtained.

OLEOMARGARINE.

The law regulating the sale of this substance has been strictly enforced during the year, and, as will be seen by the detailed report given later on, the transactions in imitation butter are now usually carried on honestly and according to the legal provisions. The number of licenses granted by the United States authorities would indicate that the demand for oleomargarine was very limited in this State. This condition would seem to indorse the statement made in a former report, to the effect that as soon as the law was rigidly enforced, and when dealers were compelled to sell the article for what it was, the amount sold in this State would be very small. In 1886 there were

149 licenses granted; during the past year only 28 were issued, and many persons holding these have abandoned the business.

Several important cases, which have been pending for nearly two years, have been decided by the Supreme Court, and all essential particulars of the law are now adjudicated upon. The recent decisions are printed at the close of the report. It is held that oleomargarine colored by its substantial ingredients does not come under the ban of the law, but it may be sold in this State if the other provisions of the law are observed.

Penalties to the amount of $1,100 have been paid to the State Treasurer.

MILK.

As will be seen by the detailed report given elsewhere, nearly all sections of the State have been visited by the Inspectors, and the milk-supply has been shown to be in excellent condition. The number of cases of adulteration of this article of food noticed this year is less than ever before. The importance of the law to farmers is being appreciated by that class, and many samples have been sent by them for analysis, in order to test the milk yielded by their herds.

The table printed on another page will show the number and results of the analyses made during the year.

Penalties to the amount of $550 have been imposed under this law and paid to the State Treasurer.

FOOD.

The examinations made of various foods prove conclusively the necessity of the present law and its rigid enforcement. Six hundred and twenty-three articles of food were analyzed during the year, and it was ascertained that over 48 per cent. were adulterated. All of these articles were purchased at retail, at the usual places of business in the State, hence the results represent the average food as furnished to our people.

While the adulterants used are rarely harmful to health, they are always fraudulent, and deprive the purchaser of an amount of money equal to the amount of adulteration; hence, if the law can but restore to the people an amount equal to that of which they are defrauded by the adulterater, many times the sum appropriated for this work shall be returned to the pockets of our citizens.

Several suits were instituted under the provisions of the Food law, but no penalties were imposed. In some cases proceedings were discontinued when the defendant promised to cease selling debased articles, or to return them to the manufacturer. In many instances the responsible person resided out of the State, and could not be reached by our legal process, but the return of his goods had as salutary an effect as if a fine had been imposed. One violation, on account of which a case was instituted in Burlington county, consisted in the sale of cream of tartar that was adulterated with 80 per cent. of sulphate of lime. The dealer had previously been warned concerning the character of the article, and had been notified to stop its sale; when this notice was not obeyed, the suit was begun. Cases were tried in Hudson county against persons manufacturing adulterated honey, and selling lard mixed with tallow. But I have thought it best to acquaint the trade with the provisions of the law before taking more vigorous proceedings. To that end some 248 warning notices have been served; these inform the dealer what the article is and with what it is adulterated. At the same time he is notified that a continuance of its sale will be followed by prosecution.

The trade has also been informed that I will examine any article of food sent to me, so that all shall know whether it is equal to the requirements of the law or not.

DRUGS.

Four hundred and fifteen articles, under this head, were analyzed; of these, nearly 56 per cent. were adulterated. The tables printed on the following pages give in detail the names and composition of all drugs analyzed.

Several special investigations were made during the year, the results of which are reported in detail, and I would call your especial attention to the remarks on canned goods, baking powders and carbonated beverages.

ANALYSES.

The analyses required by law have been made by the following chemists: Prof. Henry B. Cornwall, of Princeton College, Mr. Shippen Wallace, Mr. August Drescher and myself. Mr. Joseph F. Geisler, Chemist to the Mercantile Exchange, made the special analyses of spices.

RECOMMENDATIONS.

In a previous report I called your attention to the fact that the appointment of a State Chemist, at a regular salary, would be a more economical arrangement than the one now required by the various laws. As now managed, the outlay for analyses is very large, and this must of necessity be the case, because each law has a different requirement for the appointment and compensation of chemists. This is also the case with Inspectors under the Milk law. By the terms of that act a special appropriation is made for the hire and expenses of Milk Inspectors. This could, without interfering with the quality or extent of the work, be abandoned, by providing for the payment of all expenses out of the general appropriation.

An attempt was made by the Legislature to reduce the expenses of this kind of work, by the passage of an act providing for the construction of a laboratory building at New Brunswick. "An act to provide for the construction of a State Laboratory for the State Agricultural Experiment Station," approved April 23d, 1888, contains the following provision: "Section 2. The chemist or chemists of the State Agricultural Experiment Station shall analyze all samples of milk, butter or other farm products, or the imitations thereof, that may be sent to said Station by the State Dairy Commissioner and his assistants and agents, and shall report to said Commissioner the results of such analyses, and the costs thereof shall be paid out of the appropriation made to said Station." Upon being informed of the passage of this act I communicated with the Director of the Station, Prof. Geo. H. Cook, asking him when the Station would begin the analytical work required by this law. In reply he stated that he considered such work to be contingent on the completion of the new laboratory building, hence I have not been able to avail myself of this new and economical arrangement.

Without burdening this report with further details, I would respectfully refer to the annexed special articles, which contain items of considerable interest to the people of our Commonwealth.

It has been my aim to publish a report that will serve to educate the people concerning the food-supply, and to point out the articles that should be avoided, by giving full particulars respecting adulterations.

WILLIAM K. NEWTON,
Dairy Commissioner.

FOOD.

During the year 623 articles of food were analyzed; of these, 303 were found to be adulterated, or below the legal standards, and 320 were pure, or equal to the requirements. This shows that 48.64 per cent. were adulterated and 51.36 per cent. pure.

The following table exhibits in detail the names of the articles examined and the results obtained. Besides these articles, fifty-five analyses of baking powders were made, a separate report on which will be given at the close of this statement:

ARTICLES OF FOOD EXAMINED.

Article.	Total.	Pure, or Standard.	Adulterated, or not Standard.
Butter and Oleomargarine	68	24	44
Milk	121	78	43
Lard	141	80	61
American Canned Goods	55	54	1
Imported Canned Goods	16	5	11
Ground Coffee	24	8	16
Coffee Essence	1	0	1
Tea	19	19	0
Black Pepper	28	6	22
White Pepper	4	2	2
Cayenne Pepper	3	3	0
Mustard	41	1	40
Cinnamon	20	7	13
Cloves	13	3	10
Allspice	8	2	6
Ginger	11	8	3
Nutmeg	2	2	0
Extracted Honey	10	5	5
Maple Syrup	9	5	4
Molasses	2	2	0
Drips	1	0	1
Vinegar	12	1	11
Pickles	7	5	2
Carbonated Beverages	7	0	7
Total	623	320	303
Per cent		51.36	48.64

All of these articles, with a few exceptions, were bought at retail and at the usual places of business throughout the State, hence the results obtained represent faithfully the condition of the food supplied to the consumer in this State. As I shall comment, more or less exhaustively, on each class of articles examined, it seems unnecessary to say anything further in the way of introduction.

OLEOMARGARINE.

Frequent and systematic inspections have been made, as required by the provisions of the act to prevent deception in the sale of oleomargarine. Licenses for the sale of oleomargarine have been granted under the United States statute by the Internal Revenue Collectors, for the year ending with November 1st, 1888, as follows:

Newark	2
Jersey City	5
Hoboken	2
Paterson	5
Elizabeth	1
Orange	1
Bloomfield	1
Perth Amboy	5
South Amboy	1
Woodbridge	1
Sayreville	1
Camden	2
Vineland Salem Millville	1
Total	28
Issued in 1887	30
Issued in 1886	149

The above figures show that there are fewer dealers now in the State than during the past three years. It is also to be noted that those now dealing in imitations of dairy products endeavor to obey the law in every particular, and that attempts at fraud are rarely observed. In Jersey City, one or two stores have been opened for the exclusive sale of oleomargarine, and the public is thoroughly informed, by the display of signs, that nothing but that article is there sold. This venture, new in this State, but common elsewhere, is watched with considerable interest, with the view of determining how extensive the popular demand for the article really is.

The decision of the Supreme Court in the Waterbury and Ammon cases has been of great value, for we now are thoroughly acquainted with the true significance of the act, and dealers now know just what the law requires. The decision in the Ammon case is to the effect that the Legislature did not intend to interdict the sale of oleomargarine not deceptively colored with articles intentionally added for that purpose, and that substances faintly colored by the essential ingredients could be sold, provided that the other provisions of the law were observed. This decision has stimulated manufacturers to experiment with the production of an article that shall not violate the law in this regard. In one or two instances this has been done. The result of this phase of the subject has been to add to the work of the chemists of the commission, and the expense for this extra and delicate work has been great, but the two brands made in compliance with the decision are found to be free from added color, and no pigment or stain can be detected. Inspectors are, however, on the alert so as to check the sale of improper oleomargarine as soon as introduced on the market.

The decisions above referred to, together with the briefs in the cases, are printed at the close of the report.

Cases against violators of the act have been begun in the following places: Hudson county, 3; Union county, 1; Burlington county, 6; Somerset county, 1; Camden county, 4. Of these, eleven have been settled by conviction or otherwise, and four cases are now on the court dockets awaiting trial. Penalties to the amount of $1,100 have been paid into the State treasury.

Many samples of substances supposed to be oleomargarine have been sent to me by purchasers for analysis. In every case the article has proved to be bad butter, and it may be stated as an invariable rule that if the suspected material is rancid and has a disagreeable odor, that it is inferior butter, not oleomargarine. The latter article may become granular and have a disagreeable, greasy taste, but it never turns rancid.

The law has proved, during the time it has been in force, of value to the consumer of and dealer in pure butter. The former has been protected from fraudulent compounds, while the latter has been enabled to obtain a reasonable profit on pure dairy products.

MILK.

The usual inspection of milk has been carried on in nearly all portions of the State, with the exception of Newark, where the Board of Health has undertaken the duty of protecting the consumer from the evils of adulteration.

Complaints in cases of violation have been made in the following counties: Essex, 3; Hudson, 16; Warren, 3; Morris, 4; Sussex, 4; Camden, 2; Hunterdon, 1. Many of these cases are now pending, while the remainder are closed, either by conviction or otherwise. Penalties to the amount of $550 have been paid into the State treasury.

Never, since the law regulating the sale of milk was first enacted, has the quality of the supply been so excellent. The rigid enforcement of the act for seven years has had a salutary effect, and cases of adulteration are now rare. It is only in the large cities that adulteration is carried on to any extent.

The following table will show the results of analyses. A large number of the samples were sent by producers for the purpose of learning the quality of the milk yielded by their herds. Some of them were to test the effect of feeding:

MILK.

Number.	Where Obtained.	Total solids.	Fat.	Remarks.
1806	Mount Holly	13.66	4.06	
1807	" "	13.54	3.94	
1808	Clayton	9.08	2.23	Skimmed.
1809	"	12 40	3.20	
1638	Jersey City	11.05	3.69	Paid penalty of $50.
1639	" "	10.69	3 05	Judgment entered.
1806	Mount Holly	13.66	4.06	
1807	" "	13.54	3.94	

MILK—*Continued.*

Number.	Where Obtained.	Total solids	Fat.	Remarks.
1808	Clayton	11.55	2.23	Partially skimmed.
1809	"	12.40	3.20	
1819	Bridgeton	12.05	2.75	
1828	Point Airy	11.59	2.91	
1830	Beverly	13.90	3.20	Analyzed for producer.
1640	White House	12 35	4.15	
1641	Jersey City	12.12	4.19	
1838	Mount Holly	9.98	0.75	Skimmed milk.
1839	Lumberton	14.10	4.15	
1844	Salem	13.64	3.85	
1853	Rancocas	12.90	3.51	
1854	Mount Holly	13.38	3.78	
1855	Burlington	12.48	3.30	
1652	Jersey City	10.44	3.78	Plea of guilty; $50 paid.
1653	" "	10.24	3.28	
1651	Elizabeth	12.65	3.28	
1856	Yorktown	12.33	2.63	
1857	Daretown	9 24	2.07	Paid $50 penalty.
1654	Jersey City	11.01	3.02	
1859	Hartford	12 63	2.86	Holstein herd.
1861	Moorestown	12.20	3.01	" "
1862	"	14.80	5.00	Jersey herd.
1863	Daretown	13.56	3.66	
1864	Woodstown	9.36	2.44	
1865	"	12.33	3.13	
1866	"	13.26	3.54	
1657	Jersey City	11.39	2.96	
1658	" "	11.14	3.73	
1659	Union Hill	11.14	3.20	
1912	Mount Holly	13.67	4.29	
1913	" "	12.69	3.90	
1670	Jersey City	11.04	3.20	
1671	" "	10.35	2.98	Convicted; penalty paid.
1672	North Bergen	10.63	3.21	" " "
1673	Union Hill	10.21	2.94	" " "
1674	" "	10 21	2.53	" " "
1948	Greenwich	10 78	2.63	
1979	Pemberton	10.73	3.13	
1980	"	11.20	1.95	Skimmed milk.
1994	Greenwich	12.12	3.12	One cow.
1995	"	12.50	3.18	Herd.
2032	Jobstown	13.02	3.64	
2033	"	12.38	2.93	
2044	Pemberton	11.50	2.50	
1751	Branchburg	12.15	3.52	
1752	"	14.25	5.37	
2045	Quinton's Bridge	12.50	4.00	
1768	Union Hill	9.77	2.92	
1769	" "	12.05	4.53	

MILK—*Continued.*

Number.	Where Obtained.	Total solids.	Fat.	Remarks
1770	Hampton	9.88	2.77	
1771	"	9.33	2.41	
2052	Pemberton	9.50	0.95	
2053	"	9.86	2.48	
2054	"	12.69	3.07	
2055	Atlantic City	12.22	2 79	
2092	Pemberton	8.90	2.53	From diseased cow.
1815	Caldwell	10.92	2.74	Plea of guilty.
A 15	Asbury Park	10.44	0.74	Convicted.
B 10	State Camp	13.50	4.25	
B 15	Columbus	13.66	4.41	
B 16	"	13.00	3.73	
B 17	"	13.52	4.32	
B 45	Lambertville	11.68	1.75	
B 46	"	12.87	2.95	
B 47	"	13.19	4.70	
B 48	"	9.80	0.55	Skimmed.
A 16	Asbury Park	13.32	3.68	
A 17	" "	12.63	3.22	
A 18	" "	13.12	3.59	
B 49	Hurfville	13.01	3.85	
B 50	White Hill	14.83	4.98	
B 51	" "	15.26	5.76	
B 52	Beverly	11.98	2.34	
B 53	"	13.96	4.12	
B 54	"	11.32	1.30	
B 55	Riverton	12.21	3.09	
B 56	Camden	12.52	2.56	
B 60	Flemington	14.11	4.24	
B 61	Phillipsburg	11.90	3.56	Warning notice.
B 62	"	11.45	3.25	" "
B 67	"	10.41	0 83	Suit instituted.
B 111	"	9.44	0.42	" "
B 112	"	13.22	....	
B 130	"	12.88	....	
B 131	"	10.84	1.05	Suit instituted.
B 132	Frenchtown	13.53	....	
B 133	"	12.25	2.30	
B 134	"	13.67	....	
B 147	"	10.97	1.10	Warning notice.
B 180	Swedesboro	13.06	3.48	
B 265	Reeves	13.64	....	
B 266	Pemberton	10.03	....	
B 267	Haddonfield	11.86	....	
1459	Burlington county	12 28	2.98	
1460	Camden	13.02	3.60	
1462	"	23.00	14.13	Cream.
1463	Gloucester county	13.18	3.60	
1464	" "	13.54	4.34	

MILK—*Continued.*

Number.	Where Obtained.	Total solids.	Fat.	Remarks.
1465	Gloucester county	13.56	3.51	
1466	" "	13.90	4.00	
1467	" "	15.40	5.45	
X	Burlington	13.04	3.70	
X 109	Sussex county	11.30	1.24	Suit authorized.
1620	Jersey City	12.23	4.31	
A	Burlington	14.12	4.35	
B	"	13.84	4 42	
3001	Jobstown	12.95	3.39	
3002	"	13.66	3.84	
3003	"	15.14	5.04	
3004	"	13.79	3.89	
3005	"	14.45	4.80	
3006	"	13.94	3.97	

LARD

In my last report I devoted considerable space to the subject of lard adulteration, pointing out the character of the adulterants used and the methods employed for their detection. This year a large portion of my time has been given to an investigation of lard now supplied by dealers in this State. As was before stated, "leaf lard" is now almost a myth, as that article is only to be found on farms, or when prepared in limited quantities by local butchers. The amount thus prepared in the whole State probably would not weigh 1,000 pounds. The article sold to the consumers represents the fat of all portions of the hog, and no attempt is made to select one portion for the preparation of the product. Local packers in Trenton, Newark and other places in our State, prepare a very excellent article free from any adulteration, and they are able to supply the trade in those sections. The larger quantity used in our State comes from the West, and is rarely pure. One may judge of the quality of this article by the testimony of Mr. Fairbanks, a large Western refiner, who stated as follows before the Committee on Agriculture of the House of Representatives. He said: "Now, the great packing-houses of the West do not stop to clean the guts or make sausage-casings of them; they just wash around, not thoroughly, and then throw all into the tank—guts, heads, feet and everything. The lard-tank to-day in a packing-house is a sewer for cleaning out everything in the shape of grease, but there is no such thing as white grease, from packers, on the market. All goes into the lard—all the product that we used to buy as white grease. There is no such thing as No. 1 lard any more. It all goes in, and is all prime steam lard. The quality of it had deteriorated to such an extent that we had to get something to mitigate it—to take away the taste and the smell. The lard we get from the packers we put into a large tank, and open steam is put in and it is all boiled up with steam and washed. It is boiled for an hour or two and then allowed to precipitate, then it is skimmed off. Precipitation takes place, and it is allowed to stand for ten hours. All the ordure is taken out. Out of 100 tierces of lard we take out a tierce or two of mud. It was as black as your coat. All the packers' lard is made in that way. It contains all of this filth, necessarily, from throwing into the tank guts and everything, and steaming it all together."

This statement, couched in very plain English, defines that unsavory and mysterious compound—Western lard.

A mixture now on the market known as "refined lard" is a compound of beef fat, cotton-seed oil and hog fat, the latter in small quantities. The following table will give the results of analyses:

LARD.

Number.	Where Purchased.	Manufacturer.	Results of Analyses.
1612	Jersey City	Armour & Co.	Adulterated.
1613	" "	Bush Bros.	Genuine.
1614	" "	Halstead & Co.	Adulterated.
1615	" "	Geo. S. Napheys, "Gold Leaf"	Genuine.
1455	Burlington	Armour & Co.	Adulterated.
96	Paterson	G. Cassard & Son	Doubtful.
1469	Camden	Not known	Adulterated.
1471	"	" "	Pure.
1475	"	" "	"
1477	"	" "	"
97	Paterson	Chas. Wolfeagle	"
1481	Camden	Not known	"
1484	Bordentown	" "	"
1485	"	" "	Adulterated.
1486	"	" "	"
1487	"	" "	"
1488	"	Armour & Co.	"
1489	"	Not known	Pure.
1490	"	" "	Adulterated.
1491	"	" "	Pure.
1494	Camden	" "	"
1495	Burlington	" "	Adulterated.
1496	"	" "	"
1500	Camden	" "	Pure.
1802	"	" "	"
1810	Clayton	" "	"
1630	New Brunswick	Bartholomew & Co.	"
1633	" "	C. M. Bailey	"
1802	Camden	Not known	"
X 102	Paterson	" "	"
1447	Burlington	Armour & Co.	Adulterated.
1810	Clayton	Not known	Pure.
1812	Vineland	" "	"
1813	Millville	" "	Adulterated.
1814	"	" "	"
1816	Gloucester	" "	Pure
1817	"	" "	Adulterated.
1818	Millville	" "	"

LARD—*Continued.*

Number.	Where Purchased.	Manufacturer.	Results of Analyses.
1820	Bridgeton	Not known	Pure.
1821	"	" "	"
1822	"	" "	"
1824	"	" "	"
1825	"	" "	"
1829	Beverly	" "	"
1831	"	" "	Doubtful.
1833	"	" "	Pure.
1642	Hoboken	" "	"
1643	"	" "	Adulterated.
1645	Jersey City	N. K. Fairbanks & Son	"
1646	" "	G. C. Napheys & Son	Pure.
1648	" "	Not known	Adulterated.
1834	Cranmer's Hill	" "	Pure.
1836	Bordentown	Bunting & Sons	"
1837	"	" "	"
1842	Lumberton	N. K. Fairbanks & Son	Adulterated.
1642	Newark	" " "	"
1646	"	G. C. Napheys & Son	Pure.
1649	Jersey City	G. L. Lyons	Adulterated.
1650	" "	Rohe Bros	Questionable.
1847	Crosswicks	C. D. Lippincott	Pure.
1848	"	" "	"
1849	"	" "	"
1850	"	" "	"
1852	"	" "	"
1858	Allentown	D. M. Bunting	"
1860	Hartford	Not known	"
1871	Bridgeton	" "	"
1672	"	" "	Doubtful.
B 57	Lambertville	" "	Adulterated.
B 59	"	" "	Pure.
B 63	Phillipsburg	" "	"
B 64	"	" "	Adulterated.
B 66	"	Hall & Cameron	"
B 68	Beverly	Not known	Pure.
B 72	"	" "	"
B 75	"	" "	"
B 76	Trenton	" "	"
B 78	"	" "	"
B 81	"	" "	"
B 85	"	" "	"
B 92	Cranmer's Hill	" "	"
B 97	" "	" "	"
B 116	Phillipsburg	" "	"
B 126	"	" "	"
B 137	Frenchtown	" "	"
B 144	"	" "	"
C 1	Paterson	Cassard & Son	Adulterated.
B 87	Trenton	Not known	"
B 89	"	" "	"

LARD—*Continued.*

Number.	Where Purchased.	Manufacturer.	Results of Analyses.
B 103	Cranmer's Hill	Not known	Adulterated.
B 105	" "	" "	"
B 108	" "	" "	"
B 115	Phillipsburg	" "	"
B 122	"	" "	"
B 100	Cranmer's Hill	" "	Suspicious.
B 119	Phillipsburg	" "	Doubtful.
B 150	Vineland	" "	Adulterated.
B 154	"	" "	"
B 157	"	" "	"
B 174	"	" "	"
B 166	"	" "	Pure.
B 177	"	" "	"
B 185	Swedesboro	" "	"
B 190	"	" "	"
B 193	"	" "	"
B 197	"	" "	"
B 202	"	" "	"
B 205	Phillipsburg	" "	"
A 22	New Brunswick	" "	Adulterated.
A 26	" "	" "	Suspicious.
A 27	" "	" "	Pure.
A 38	Elizabeth	" "	"
A 40	"	N. K. Fairbanks & Son	Adulterated.
A 41	"	" " "	"
A 249	Jersey City	Not known	"
A 250	" "	" "	Suspicious.
C 9	Paterson	Armour & Co.	Adulterated.
X 103	"	Not known	Genuine.
X 104	"	" "	"
X 105	"	" "	"
C 54	"	H. Muhs	Pure.
B 207	Salem	Not known	Adulterated.
B 209	"	" "	"
B 210	"	" "	Pure.
B 211	"	" "	Doubtful.
B 215	"	" "	Pure.
B 220	Vineland	" "	Adulterated.
B 225	"	" "	Pure.
B 226	"	" "	"
B 230	"	" "	Doubtful.
B 238	"	" "	Adulterated.
B 240	"	" "	Pure.
C 18	Paterson	Armour & Co.	Adulterated.
C 19	"	N. K. Fairbanks & Co.	"
A 252	Jersey City	Rohe Bros.	"
A 253	" "	Cobb Bros.	"
B 247	Bridgeton	Not known	Pure.
B 251	"	" "	"
B 255	"	" "	"
B 256	"	" "	"
B 258	"	" "	"

AMERICAN CANNED GOODS.

◆

Considerable attention was given to the examination of vegetables and meats packed in tin vessels. The frequent statements to the effect that articles thus preserved often contained dangerous quantities of the poisonous metals, and the importance of the canning industry in our State, have prompted me to investigate the subject closely.

Previous examinations had been made by the chemists of the State Board of Health, but the records were not available or were imperfect, hence I decided to re-open the question and initiate a new line of analyses.

During the year just closed, 3,319,437 cans of tomatoes alone were packed in the United States, our State of New Jersey contributing its quota of 789,363 cans. When we know that the amount of corn, beans, asparagus, peas and fruits packed during the year is not included in the above figures, we cannot but be impressed with the importance of this industry to the farmers, the packers and the consumers. If there is any danger to health due to the use of these articles it should be disclosed and steps taken to prevent it. But if this class of food is healthful, we should strive to encourage its use and to stimulate this important industry.

It has been my custom for the past few years, to investigate all reports of poisoning supposed to be due to the eating of canned articles. As soon as a newspaper report reached me an investigation was begun, and in no instance did I find a well-authenticated case of poisoning from the use of these articles.

It is claimed that lead and tin have been found in large quantities in canned vegetables. My investigations have never revealed a single case where lead was in quantities large enough to detect. If that metal is present in these preserved foods, immediate steps should be taken to prevent the sale of articles so contaminated, for it is well known that the constant ingestion of very minute quantities of lead, and some of its salts, is almost invariably followed by symptoms of poisoning. And these symptoms are well marked and known to every physician, hence, if there are cases of lead-poisoning due to this cause, a short time only would elapse before they would be placed on record. Lead is a cumulative poison and is very slowly cast out by the system, but the ingestion of quantities as small as the $\frac{1}{24}$ or $\frac{1}{100}$ of a grain for a time, is almost certain to be followed by symptoms of poisoning. I mention these well-known facts, for the following reasons: First, if there have been cases of lead-poisoning caused by the use of canned foods contaminated with this metal, the medical profession would have, ere this, published accounts of the cases; second, the contrast between this metal and tin is so marked that the mere mention of the facts will be convincing.

There is no doubt but that tin is frequently found in the articles preserved in vessels made of that metal. Especially so is this the case with acid vegetables like tomatoes, and in the following tables it will be noticed how often it has been revealed by the analyses just concluded. This being the case, the question is naturally asked, Is this metal poisonous, or are the quantities detected of any importance? Tin is commonly considered, next to iron, one of the most innocuous of the baser metals; nearly all of our culinary vessels are made of it, and their use is never followed by any ill results. All the evidence regarding the effects of tin on the system is negative; there are no recorded cases of poisoning, and, in fact, no mention is made in the authoritative works on toxicology of tin as a dangerous metal. The only instances where poisonous properties have been claimed for tin are in the records of cases of adulteration of molasses by a certain salt of that metal. Such cases were tried in the Massachusetts courts, but the evidence was not conclusive. We may then accept the facts in this relation, and state that, so far as scientific records now go, and so far as evidence is recorded, the quantity and quality of tin as found in canned foods are not injurious.

The following statement of Mr. Shippen Wallace, the Chemist of the State Board of Health, who made all of the analyses recorded below, will be of interest. He says:

"The accompanying tables show the names of the various packers whose canned goods were bought in the open market, and examined with especial reference to the detection of the presence of lead or tin, the assertion having been made that the former was quite often present.

"In all the goods examined no lead was found, while tin was detected in traces merely, in all the tomatoes, unless the contents were in a bad condition, and then, of course, in larger quantity. There was but one can in all which was not in prime condition. This, however, may, and undoubtedly does, occur in the goods of all packers to a small extent; but because one can should be of poor quality, is no reason why the remaining ninety-and-nine should be condemned. The fact cannot be too thoroughly impressed on the community, that the present system of canning vegetables is of inestimable value; but the same rules should be followed which are made use of with fresh vegetables in their use, that is to say: if on opening a can the contents are spoiled, act as one would with fresh vegetables under similar circumstances—throw them away. This done, there is no possible danger in their use; but if not, the same risk is run as would be in the use of spoiled fresh vegetables, only to a greater extent.

"In the case of canned asparagus, a large amount of tin was found, and the interior of the can was invariably blackened. This comes from the acid of the asparagus, or what, in my opinion, is more likely, from the use of certain ingredients in the process. I am of the opinion that there may be a slight danger from this cause, and that it would be better, and should be so recommended, to use glass in the place of tin, as is done by a few. With the exception of asparagus, there cannot be the slightest danger in the use of any canned goods that I know of, if they are in good condition, and are not allowed to remain in the can after being opened. This last rule should be strictly followed."

Of all cases of sickness caused by eating canned goods, the cause has always been found to have been that the contents were spoiled when opened, or the can had been allowed to remain open for a day or more before the contents were used.

The following tables show the articles examined and the results of the analyses:

TOMATOES.

Office No.	Packer.	Tin.
A 266.	J. H. Butterfoss	Trace.
A 267.	Jas. C. Reed	"
A 468.	R. D. Hughes	"
A 291.	W. H. Bickmore	"
A 287.	H. Stapler	"
A 290.	John F. Lowden	"
A 283.	Farmers' Preserving Co.	"
A 276.	Davis & Draper	"
A 280.	Pogg & Hires	"
A 274.	Zack Johnson	"
A 278.	W. E. Jewens	"

Office No.	Packer.	Tin.
A 281.	Kirby Bros	Trace.
A 295.	Hubbard Bros	"
A 269.	C. Smith & Bro	"
A 289.	S. L. Webster	"
A 279.	Jas. Wallace & Son	"
A 285.	Montecute Packing Co	"
A 284.	Githens & Rexamer	"
A 288.	John F. Lowden	"
A 282.	Unknown	"

The contents in each case were in good condition. No lead was detected in any of the samples.

CORN.

Office No.	Packer.	Tin.
A 277.	S. E. Aldrich	None.
A 293.	Chesneys' Brand	"
A 276.	Harrington Brand	"
A 270.	Unknown	"
B 264.	Erie Preserving Co	"

The contents in each case were in good condition. No lead was present in any of the samples.

PEASE.

Office No.	Packer.	Tin.
A 272.	Kensett & Co	Trace.
A 271.	Boyers' Brand	"
A 275.	A. Brakeley	None.
A 208.	J. B. Drake	"
A 236.	A. Brakeley	"

All in good condition. No lead or copper found.

BEANS.

Office No	Packer.	Tin.
A 292.	Kensett & Co	None.
A 294.	D. S. Truitt.	Trace.
A 60.	Wm. Humsen	"
A 210.	Moore & Brady	None.
A 77.	" "	"
A 82.	J. H. Mohlman & Co	"
A 201.	H. S. Horne & Co	"
A 227.	Thompson, Fry & Co	"

All in good condition. No lead present.

SQUASH.

Office No.	Packer.	Tin.
A 286.	E. B. Jones & Co	None.

ASPARAGUS.

Office No.	Packer.	Tin.
A 211.	S. E. Aldrich	6 grains.

CORNED BEEF.

Office No.	Packer.	Tin.
A 228.	Fairbanks & Co	None.
B 194.	Armour & Co	"

SUNDRIES.

Office No.	Article.	Packer.	Tin.
B 140.	Lobster	Winslow Packing Co	None.
B 145.	Salmon	Mount Hood Packing Co	Trace.
B 159.	Baked Beans	Burnham & Morrill	"
B 175.	Sardines	Blanchard & Sons	None.
C 92.	Potted Partridge	Franco-American Food Co	"
A 233.	Salmon	Oregon Packing Co	"
A 234.	Sardines	E. A. Holmes	"
A 235.	Mackerel	Eagle Fish Co	"
C 90.	Mock Turtle Soup	Franco-American Food Co	"
C 91.	Green Turtle Soup	" " "	"
C 93.	Vegetable Soup	" " "	"
C 94.	Consommé Soup	" " "	"

All of the above were in good condition. No lead was detected.

As satisfactory as these results are, we shall continue the investigation during the present year, and shall pay especial attention to the sheet tin of which the cans are made, with a view of ascertaining its composition.

IMPORTED CANNED GOODS.

Sixteen cans of imported vegetables were examined, and copper was found in eleven. It is the custom of many foreign packers to add small quantities of sulphate of copper (blue vitriol) to pease and beans, the object being to give a green color to these articles. As the addition of any coloring material is prohibited by law, proceedings should be taken against dealers in these articles. The following table is published with the object of informing the public, so that they may select the brands not containing copper:

IMPORTED CANNED VEGETABLES.

Number.	Article.	Name of Packer.	Quantity of Copper Present.
1945	Pease	F. Roudenet, Nantes	0.970 gr. in ℔.
2002	"	G. Talbot, Bordeaux	None.
1662	"	Alex. Bernard, Bordeaux	0.55 gr. in ℔.
B 109	"	G. Talbot, Bordeaux	None.
B 191	"	F. Roudenet, Nantes	Copper.
B 70	"	Duprat, Clement & Maurel, Bordeaux	"
A 58	"	E. M. Dadelzen, Bordeaux	"
A 66	"	L. A. Price, Bordeaux	None.
A 202	"	Eugene du Raix, Bordeaux	Copper.
A 230	"	J. Fiton Aine, Bordeaux	"
A 207	"	D. M. Ausone, Bordeaux	None.
A 251	Beans	G. Talbot, Bordeax	Copper.
A 247	Mushrooms	J. Fiton Aine, Bordeaux	None.
B 232	Pease	Eugene du Raix, Bordeaux	Copper.
B 244	"	Guillaumez, Nancy	"
A 69	"	Gabriel Triat & Co., Bordeaux	"

GROUND COFFEE.

Twenty-four samples of ground coffee were examined, eight of which were pure and sixteen were adulterated. The adulterants found were roasted and ground pease, beans, rye, wheat and chicory. The agent purchasing the samples asked for coffee and paid the usual retail price, hence expected to receive the genuine article.

GROUND COFFEE.

Number.	Where Bought.	Label on Package.	Results of Analysis.
1881	Beverly	Sold in bulk	Adulterated.
1845	Hancock's Bridge	" "	"
1826	Woodstown	"Blue Seal," Wm. Scull & Co.	"
1815	Millville	"Sunrise," Weikel Spice Co.	"
1832	Beverly	"Partola," Henry Meyer & Co.	Not adulterated.
B 254	"	"None Such"	Adulterated.
1823	Bridgeton	" "	"
B 158	Vineland	Brooks, Brower & Ware	"
A 37	Elizabeth	"National," Davis, Silvers & Co.	"
A 8	Newark	Sold in bulk	"
A 12	"	" "	"
1702	Jersey City	" "	Pure.
1700	" "	" "	"
1742	Somerville	" "	"
1763	Plainfield	U. P. T. Co.	Adulterated.
A 3	Newark	G. A. & P. T. Co.	"
1810	Trenton	Sold in bulk	Pure.
1703	Jersey City	"8 o'clock Coffee"	Adulterated.
A 34	Elizabeth	Sold in bulk	"
A 28	New Brunswick	" "	Pure.
A 14	Newark	" "	Adulterated.
A 23	New Brunswick	" "	Pure.
A 42	Elizabeth	" "	"
A 48	Trenton	Union Pacific Tea Co.	Pulverized.

Besides the above, one sample of "George Hummel's Premium Essence of Coffee" was analyzed. It was composed of burnt molasses, roasted ground corn and no coffee.

TEA.

Nineteen samples of tea were purchased in different places in the State; these were analyzed, and duplicate portions sent to Messrs. James and John R. Montgomery, of No. 127 Water street, New York, the oldest and most expert tea brokers in the trade, for their opinion as to quality and purity. The results obtained show that, while there is no adulteration, there is a large amount of inferior and debased tea sold in the State. The United States law prevents the importation of the adulterated article, but much that comes to this country is of very poor quality, having little of the flavor of the true leaf.

The table given on the following page will be of interest, as it gives the names of the grades used by dealers:

TEA.

Office number.	Where Purchased.	Quality.	Price paid per pound.	Wholesale value per pound.	Remarks.
1741	Somerville	Mixed Oolong and Young Hyson	40c.	23c.	Principally Young Hyson.
1764	Plainfield	Amoy Oolong	80	17	
A 13	Newark	Mixed Oolong, Formosa and Green	32	20	
A 33	Elizabeth	Mixed Oolong, Amoy and Hyson	62	17	
1811	Trenton	Green Pingsuey Gunpowder	62	18	
A 39	Elizabeth	Formosa Oolong, good cargo grade	40	21	
A 35	"	Formosa Oolong, low superior grade	62	24	
A 24	New Brunswick	Mixed, Formosa Oolong and Young Hyson	40	25	
A 43	Elizabeth	Mixed, Formosa Oolong and Young Hyson	40	25	
A 36	"	Mixed, Formosa Oolong and Young Hyson	40	20	Mostly Young Hyson.
A 29	New Brunswick	Formosa Oolong, fair and good grades	62	20	
A 25	" "	Japan, good common grade	40	14	
A 7	Newark	Mixed Common Green and Amoy Oolong	40	14	Dusty.
1705	Jersey City	Amoy Oolong, common grade	40	15	
1701	" "	Mixed Amoy Oolong and Young Hyson	52	20	Mostly Young Hyson.
A 11	Newark	Mixed Amoy Oolong and Hyson	40	18	
A 4	"	Mixed Oolong and Japan Young Hyson	40	19	
1704	Jersey City	Mixed Oolong and Hyson	40	19	
1699	" "	Mixed Oolong Green and India	62	23	

GROUND SPICES.

The adulteration of ground spices and condiments may now be regarded as one of the fine arts, and much skill is shown in the methods of sophistication, and considerable time is given to the invention of new combinations. If a spice-grinder can take buckwheat hulls, cocoanut shells, properly charred, and a little cayenne for flavoring, mix them thoroughly, affix a gaudy label "pure pepper," and then persuade the consumer that the article is pure and unadulterated pepper, he is certainly entitled to the name of artist, or, at least, necromancer. This is done constantly; and he is also able to combine corn meal, turmeric and a modicum of cayenne, and by a kind of legerdemain transmute the mixture into "pure ginger." These facts are by no means new, for there is no class of articles used for, or in the preparation of, food that is so commonly and systematically debased; and this has been the case for centuries. As early as 1316, an ordinance was passed for the government of dealers in pepper and spices in London. Since that time the adulteration of this class of food has very frequently called forth the edicts of lawgivers.

More work has been done by those studying the subject of food adulteration, and more has been written in this particular line of investigation, than in any other within the domain of chemical and microscopic analysis. Every book, pamphlet and treatise on the subject of food sophistication contains extensive notes regarding spice adulteration and its detection. The last and most valuable contribution, "Bulletin 13, Part 2d, United States Department of Agriculture, Foods and Food Adulteration," contains no less than 120 pages on this subject alone. New adulterants are being constantly discovered, and as soon as the analyst has become acquainted with them, he is called on to identify a recent invention and to investigate the use of an entirely new article. And so the war between the spicemixer and the analyst goes on, and they follow each other with alternate detection and mystery.

In the next few weeks our microscopists will have to grapple with a new adulterant that they shall find in white pepper, and they will not identify it unless prepared to recognize "grains of Paradise."

Dr. E. H. Bartley, of the Brooklyn Board of Health, who has recently been the rounds of the spice-mills, and who has been initiated into the mysteries of spice-grinding, very kindly sent me a few notes on the subject, which I here transcribe. He says:

> "Both of the mills I visited have sales-rooms in New York, while the grinding only is done here. According to their own statement, a very considerable proportion of the cheap mixtures made by them are sold to the trade, and are not sold under the firm name, that is, these mixtures are prepared in the mills and sold in bulk to other firms, who put them up in packages and sell to retailers, or ship in bulk to Western cities. It is, therefore, not easy to trace a large part of these adulterated goods after they leave the mills. That they reach the market is certain, because they would not be manufactured for any other purpose. The information here given is based upon what I saw in the mills. Mustard was in process of preparation at only one of the mills. So far as my observation, on two separate occasions, went, the oil was expressed from all the mustard used in the factory. The cake from the press, after removing the oil, is used for the manufacture of table mustard. The hull or chaff from the black seeds was removed and used as an adulterant of black pepper. Besides the pure mustard prepared from the expressed seeds, mixtures are made containing corn meal, ginger, turmeric and red pepper. In some cheap mustard compounds there is but little mustard, and, according to the statement of the workmen, a mixture is sometimes made that contains no mustard at all, the necessary pungency being obtained by the addition of cayenne pepper. Ginger was being prepared of several grades, varying from the pure article to those containing none at all. The adulterants used were corn flour, corn meal, pilot biscuit and cayenne pepper. In one of the mills I was shown a very good imitation of ground ginger, but which contained no ginger whatever. I was unable to learn for whom this was made, but was informed that there was a demand for it, and that it was used by the compounders. Cloves were seen in the process of grinding; they were mixed with burnt or charred walnut shells, to the extent of 50 per cent. Cinnamon is cheapened by the addition of ground almond and cocoanut shells. In order to brighten the color of this mixture, a small amount of sienna is added. In some cases the cinnamon bark is ground alone, but in all the above mixtures which I saw in process of preparation, the cinnamon buds were mixed with

the bark before grinding. There were very large quantities of ground cocoanut shells used at this factory. A very small amount of cayenne pepper is used to increase the pungency of these reduced cinnamon mixtures. I was shown several barrels of pepper compound, which was a very good imitation of ground pepper; it, however, contained no trace of pepper. This article was for shipment to New York, to be used for the purpose of 'reducing' ground pepper. Following is a list of articles used at this mill for adulteration: Cocoanut shells, natural and charred; walnut shells, corn meal, buckwheat hulls and middlings, mustard chaff, ground charcoal and cayenne pepper."

Besides the articles above mentioned, grains of Paradise, turmeric, charred bread and biscuit, and ground and charred grains are used.

Knowing all these facts, I was prepared to find a large amount of adulterated spices in our market, and the results of the analyses warranted the investigation.

I at first thought that the publication of all the names on packages, both of pure and impure spices, might be followed by good results, but after consideration of the probable results I have omitted names, for the present, and if inspection during the present year shows no improvement, all names on labels will be printed in the next report.

The following facts are deduced from the results of the investigations: 1. A few dealers put up nothing but absolutely pure spices, and every package examined bearing these dealers' names proved to be of excellent quality. 2. Several spice-mills and wholesale dealers put two grades on the market—one pure, the other adulterated. 3. Many houses selling spices sell nothing but adulterated articles. 4. Spices sold in bulk are almost invariably adulterated. 5. The price paid the retailer is no guarantee of the quality. 6. The retail dealer and the consumer are jointly responsible for the adulteration—the former by encouraging the sale of cheap and impure articles, the latter in trying to get spices at a less price than will warrant the sale of pure articles.

The following tables show the results obtained:

BLACK PEPPER.

No.	Where Bought.	Results of Analysis.
95	Newark	Adulterated.
1878	Beverly	"
2014	Cape May	"
2006	" "	"
2034	Jobstown	"
2042	"	"
2047	Quinton	Pure.
A 254	Jersey City	An excess of mineral impurities and starchy matter.
A 259	" "	" " " " " " "
A 302	Trenton	Pure.
B 96	Cranmer's Hill	Highly adulterated.
B 104	" "	Adulterated.
B 106	" "	Highly adulterated.
1667	Jersey City	Adulterated.
B 114	Phillipsburg	"
B 118	"	Highly adulterated.
B 127	"	Adulterated.
B 259	Bridgeton	"
B 241	Vineland	"
B 125	Phillipsburg	Highly adulterated with starch and nut-shells.
C 22	Paterson	Not adulterated.
A 72	Jersey City	Adulterated.
A 88	" "	Not adulterated.
C 43	Paterson	" "
C 45	"	Adulterated with pepper hulls.
C 47	"	Adulterated with starchy matter, pepper hulls and earthy matter.
C 56	"	Adulterated.
C 70	"	Pure.

GROUND GINGER.

No.	Where Bought.	Results of Analysis.
2012	Cape May	Adulterated with starchy matters.
A 258	Jersey City	Pure, African, unbleached.
A 298	Trenton	"
B 171	Vineland	Adulterated with starchy matters.
B 182	"	" " " "
B 260	Bridgeton	Pure, African, unbleached.
A 89	Jersey City	" " "
C 41	Paterson	" " "
C 66	"	" Jamaica, bleached.
C 59	"	" " "
C 69	"	" " "

CAYENNE PEPPER.

No.	Where Bought.	Results of Analysis.
C 52	Paterson..............	Pure.
C 61	"	" capsicum.
C 62	"	"

WHITE PEPPER.

No.	Where Bought.	Results of Analysis.
A 300	Trenton................	Pure.
C 23	Paterson	Small amount of corn starch.
C 44	"	Pure.
C 46	"	Adulterated with starchy matters.

GROUND CINNAMON.

No.	Where Bought.	Results of Analysis.
1879	Beverly...............	Adulterated.
2011	Cape May...........	"
2007	"	"
2043	Jobstown	"
2050	Quinton	Pure cassia.
A 260	Jersey City...........	Cassia, inferior quality.
A 89	"	" " "
A 297	Trenton	Not adulterated.
B 165	Vineland..............	Adulterated.
B 170	"	"
B 183	Swedesboro..........	"
B 187	"	"
B 198	"	"
B 201	"	Cassia of inferior quality.
C 38	Paterson..............	Pure cassia of good quality.
C 50	"	" " " "
C 63	"	" " excellent quality.
C 64	"	True cinnamon, pure.
C 65	"	Pure cassia of excellent quality.
C 57	"	Cassia of inferior quality.

GROUND NUTMEG.

No.	Where Bought.	Results of Analysis.
C 40	Paterson	Pure, of excellent quality.
C 51	"	" " "

GROUND CLOVES.

No.	Where Bought.	Results of Analysis.
1876	Beverly..............	Adulterated.
2013	Cape May...........	"
2005	" "	"
2037	Jobstown............	"
2046	Quinton	"
A 256	Jersey City..........	Adulterated with clove stems, etc.
A 299	Trenton..............	Pure.
B 129	Phillipsburg	Adulterated with nut-shells.
B 217	Salem	Adulterated.
A 90	Jersey City..........	Adulterated with clove stems, etc.
C 39	Paterson	Pure.
C 49	"	"
C 58	"	Adulterated with starchy matter.

GROUND ALLSPICE.

No.	Where Bought.	Results of Analysis.
1877	Beverly...............	Adulterated.
2004	Cape May............	"
A 257	Jersey City..........	Adulterated with clove stems, etc.
A 261	" "	Not adulterated.
C 42	Paterson	" "
B 203	Swedesboro..........	Adulterated.
A 87	Jersey City..........	Inferior quality.
B 218	Salem	Adulterated.

MUSTARD.

No.	Where Bought.	Results of Analysis.
1880	Beverly..................	Adulterated with flour and turmeric.
2036	Jobstown..............	" " " " "
2049	Quinton................	" " turmeric.
A 206	Trenton................	" " flour.
A 212	"	" " "
A 213	"	" " " and turmeric.
A 229	"	" " "
A 242	"	" " " " "
A 243	"	" " "
A 244	"	" " "
A 60	Jersey City..........	" " " " "
A 64	" "	" " "
A 68	" "	" " "
A 70	" "	" " "
A 74	" "	" " " " "
A 76	" "	" " "
A 78	" "	" " "
A 81	" "	" " "
B 113	Philipsburg..........	" " "
B 120	"	" " "
B 124	"	" " "
B 128	"	" " "
C 26	Paterson................	Pure.
B 136	Frenchtown..........	Adulterated with flour and turmeric.
B 141	"	" " " " "
B 143	"	" " " " "
B 148	Vineland.............	" " " " "
B 151	"	" " "
B 156	"	" " "
B 163	"	" " " " "
B 168	"	" " "
B 172	"	" " "
B 178	"	" " " " "
B 181	Swedesboro...........	" " " " "
B 184	"	" " "
B 189	"	" " "
B 192	"	" " " " "
B 196	"	" " "
B 200	"	" " "
B 213	Salem.....................	" " "
B 219	"	" " "

EXTRACTED HONEY.

Ten samples of extracted honey were examined; five were adulterated with glucose. The plea is made by the mixers that the addition of glucose is necessary to prevent the "candying" of the honey; that this is only a subterfuge, and is no excuse for adulteration, is proved by the fact that the pure extracted honey examined had no deposit or "candy" in the vessels containing it.

EXTRACTED HONEY.

No.	Name on Label.	Results of Analysis.
B 153	None	Pure.
B 179	McCaul Bros. & Hildrith	Adulterated.
A 65	Watson's Clover Honey	"
A 71	Geo. D. Powell	"
A 75	Coudrey & Co	Pure.
A 231	J. V. Hutchinson, Trenton	"
A 232	W. G. Griffiths	"
A 248	Chas. Israel	Adulterated.
B 88	J. V. Hutchinson	Pure.
B 231	G. & R	Adulterated.

MAPLE SYRUP.

This is commonly adulterated with water and molasses; glucose is also added as an adulterant.

MAPLE SYRUP.

No.	Name on Label.	Results of Analysis.
1997	None	Adulterated.
A 92	"	Suspicious.
A 93	Echo Farm, Vermont	Pure.
A 94	E. A. & P. Walker	Adulterated.
A 95	Chas. Israel, New York	"
A 96	Thurber, Whyland & Co	Pure.
A 97	E. T. Coudrey & Co	"
B 84	Thurber, Whyland & Co	"
1661	None	"

Besides the samples of honey and maple syrup, there was examined an article marked "White Clover Drips," which the maker did not claim to be either of the above. Analysis showed it to be glucose syrup, flavored with some essence.

MOLASSES.

Two samples of molasses from Beverly and Camden were analyzed. No. 1946 was a pure cane syrup, containing 39 per cent. of sugar; the other, No. 1478, was a pure syrup, containing 45 per cent. of sugar. It had been bleached with sulphurous acid.

VINEGAR.

A special law regulating the sale of vinegar was adopted by the Legislature, but only Inspectors appointed by the Boards of Freeholders have authority to act under it. It requires at least 4.50 per cent. of acidity. The below-mentioned samples were examined with special reference as to whether they were cider vinegar or not.

Number.	Acidity, per cent.	Cider or other vinegar.
1884	3.10	Cider.
1419	9.75	Not cider.
1420	7.50	" "
1426	5.50	" "
1430	5.00	" "
1421	6.00	" "
A 239	3.32	" "
X 1	4.00	" "
X 2	4.33	" "
X 3	2.18	" "
X 4	5.23	" "
X 5	3.40	" "

PICKLES.

Seven samples of pickles were examined, to determine the presence of copper. Two samples contained that metal.

PICKLES.

No.	Name on Label.	Acidity of Vinegar.	Metals Present.	Cider Vinegar.
1998	"The Brownies"	3.1 per cent	No	No
1999	Westchester Pickle Co.	2.85 "	"	"
2009	F. & J. Heinz	2.65 "	"	"
1668	None	3.00 "	"	"
A 205	H. Irwin		"	"
A 209	None		Copper	Yes
A 245	"		"	"

THE FOOD AT THE STATE CAMP.

◆

During the encampment at the State camp at Sea Girt, the food supplied to the soldiers was frequently examined. The result of these investigations was as follows: Milk, pure and of good quality; meat of excellent quality; bread, sweet and well baked; butter, pure; ground coffee, adulterated; lard, adulterated; tea, Souchong, of good grade; sugar, pure.

LEAD IN CARBONATED BEVERAGES.

My attention was called to a case of lead-poisoning in Paterson, with the request that I endeavor to ascertain the cause. The man thus affected was the keeper of a beer saloon, but was a total abstainer from beer. That enabled us to exclude a common cause of lead-poisoning; that is, beer allowed to stand in lead pipe. It was ascertained that he drank a large quantity of lemon soda-water, as usually furnished in bottles with an adjustable stopper. I found that the contents of these bottles were acid, and that they were largely contaminated with lead. This metal came from the stopper, which is made of an india rubber ring held in place by a metal button. Through the latter is inserted a piece of wire, coated with zinc. The metal button is made of an alloy of tin and lead. As these bottles are kept in an inverted position, the metal is constantly bathed in the acid fluid, hence not only is solution of the metal rendered possible, but this is hastened by the galvanic action between the button and the wire. At the time the above investigation was being made, Mr. August Drescher, one of the chemists of this Commission, was conducting a separate and independent series of experiments for the bottling trade in Newark. The results he obtained were identical with mine, and he kindly placed at my disposal the following notes. He states: "'Soft' drinks, such as lemon and vanilla soda-water, sarsaparilla, ginger beer, etc., are usually put up in bottles with metal stopples. Lead has been found in these drinks as well as in the stopples, and a number of cases of lead-poisoning are said to be due to the use of these beverages. Since last spring I have examined, qualitatively, twenty-eight samples of soda-water put up in these bottles. All but four were found to contain lead. Recently quantitative determinations of the lead in five bottles of soda-water have been made at my laboratory, with the following results:

No.	Lead found. Troy grains.
1	$\frac{1}{64}$
2	$\frac{1}{5}$
3	$\frac{1}{30}$
4	$\frac{1}{20}$
5	$\frac{1}{12}$

"Each bottle contained about half a pint. The stopples of all of these bottles consisted of a loop of coated brass wire, and a tin button containing lead, with a rubber belt. The analysis of some of them showed the presence of lead, copper, zinc and tin."

In view of these facts, some action should be taken to prevent the use of bottles provided with this style of stopper.

NOTES ON THE BAKING POWDERS SOLD IN THIS STATE.

Samples of nearly all of the different brands of baking powders for sale in this State were purchased and sent to Henry B. Cornwall, Ph.D., Professor of Analytical Chemistry at the John C. Green School of Science, Princeton College. He was requested to make the necessary analyses to determine the ingredients of the powders, to ascertain the leavening power or strength of each, and to report on the character of the substances used in their composition, with especial reference to the healthfulness or otherwise of the residues left in the bread after baking. It was at first intended to make a special inquiry regarding these residues, and to make tests of the powders by preparing a portion of bread with each. But the expense and time necessary to carry on this elaborate and costly series of experiments have been spared us, as Professor Mallet, of the University of Virginia, has recently completed an investigation in this very line of work, hence it is only necessary to refer to his report for information concerning this branch of the subject. His paper is quoted liberally in Professor Cornwall's report; it may be read in full in the London *Chemical News* for December 7th and 14th, 1888.

The opinions given in the report of Professor Cornwall are based on some 55 analyses of 39 brands of baking powders, as follows:

	Analyses.	Brands.
Cream of tartar and bi-carbonate of soda powders	13	8
Phosphate of lime and bi-carbonate of soda powders	7	4
Alum, phosphate of lime and bi-carb. of soda powders	26	20
Alum and bi-carbonate of soda powders	6	4
Unclassified	3	3

His report, and the analyses accompanying it, constitute an extremely valuable and impartial contribution to the literature of the subject, besides being of great importance to all who use baking powders. A careful study of his paper is recommended, as one can thereby be the better qualified to form an opinion on the relative healthfulness of the different brands of powders, and be prepared to accept or disprove the biased statements put forth in circulars and advertisements issued by manufacturers. Comparing the deductions given in that report, which are founded on experiment and scientific investigation, with the mere bald statements of advertisers, will show the consumer which is correct.

As was stated, each sample submitted to analysis was purchased at retail in this State, by myself or one of my agents; each package was in its original form, and the seals and wrappers were undisturbed when delivered to Professor Cornwall. The greater number of the inferior grades of baking powders were only to be had at stores patronized by poor people, or those of moderate means; hence we are forced to believe that any fraud in these articles is perpetrated at the expense of those least able to bear it. Many of the brands had no name of manufacturer or maker on the package; these were almost invariably of very poor quality, and containing ingredients of doubtful salubrity.

Another point worthy of note is, that large quantities of inferior baking powder are sold in bulk by manufacturers. This is put up in boxes by the retailer and a fancy label affixed, he knowing nothing about the composition of the substance—its cheapness only concerning him.

As will be seen later on, the formula of a reliable and efficient powder can only be elaborated after experiment, with the assistance of a competent chemist, and the ingredients themselves must be pure, healthful and frequently tested. Rather than trust to baking powders made by unreliable persons, sold without the indorsement of responsible manufacturers or composed of unhealthful materials, our housewives are recommended to rely on that well-known and accepted leavening agent, yeast, which can never do harm.

During the time the samples were being collected, it was ascertained that some of the makers of and dealers in the inferior grades of baking powders joined with their business another undertaking, that of a lottery or gift enterprise, and plates, cups, lamps, pewter casters and other household goods were given away with a certain number of cans, or a can of baking powder was given with a certain quantity of tea or coffee. It was stated in one section of the State, that one enterprising manufacturer offered a wagon with each purchase of a certain number of cans.

The above facts are given for the information of the people, for, as I stated before, the functions of this office are not only to arrest fraud, but to educate the people so that they shall be enabled to select their food, regarding both health and economy; and if by this process of education our citizens are told where and how to avoid fraud in the food-supply, the work of the department shall not be for naught.

Exhaustive and thorough as is the report of Professor Cornwall, there are one or two points of importance not touched on therein, hence I have thought it proper to discuss the subject of bread-making, stating a few facts relating to the chemistry of the subject, with especial reference to the differences between bread raised by the use of yeast and that prepared with other leavening agents.

From inquiries made in various parts of this State, and from knowledge gained in conversation with those conversant with the habits of all classes of our people, I may say that the use of baking powders is confined to the preparation of biscuits, cake and articles other than bread. The biscuit thus prepared is usually eaten hot, and constitutes a very large portion of the dietary of our working people. In the homes of many of our wage-workers, this biscuit made with baking powder is the usual form of bread used for at least two-thirds of the time, fresh, yeast-leavened bread being the exception. This, of course, does not obtain in the large cities, where bread is easily bought. It may be said, without fear of contradiction, that bread made by means of yeast is by far the most satisfactory and the most healthful of all the preparations of flour. It contains no residue about which there can be any controversy, it contains no added chemical; it retains, with but little change, the nutritive elements of the flour. Hence, while baking powders may answer for occasional use, they cannot be recommended as a complete substitute for yeast, as their action is different and the product dissimilar from that obtained from fermentation.

The chief agent that gives the loaf made with yeast its lightness or vesiculated structure, is the carbonic acid gas produced by the action of the ferment on certain elements of the flour. The gas in this case is generated very slowly, generally in seven to nine hours, and raises the loaf until all fermentation is checked by the heat of the oven. This peculiar action has never been imitated by any baking powder, and the thorough vesiculation accomplished by the true leaven is not equaled by any rapidly-acting chemical agent.

The nearest approach to bread made by fermentation is the so-called aërated bread so extensively used in England and Scotland. The aëration or vesiculation in this case is accomplished by the introduction of carbonic acid gas into the dough. It was made in New York a few years ago, but its insipid taste and dryness prevented its popular use.

The carbonic acid gas, as we have seen, is the agent that raises or vesiculates the bread; hence for years experiments were made with various articles, to ascertain if this gas could not be generated and introduced in the bread independent of fermentation, and for a long time this was done in our households by the use of saleratus (bi-carbonate of potash) and cream of tartar mixed with the flour at the time of baking. At one time hydrochloric acid and bi-carbonate of soda were employed, in England, for that purpose. The difficulty of combining these agents in the proper proportion interfered with the success of the experiment, or an indigestible, bad-tasting product resulted. The use of saleratus has been abandoned, and now the common source of the gas is the bi-carbonate of soda. Prior to the manufacture of baking powders the mixture was made at the time of use, and the kitchen rule-of-thumb was from two to three spoonfuls of cream of tartar to one or two of the soda. As these measures were often inaccurate, the biscuit thus made was far from palatable, and often contained small, unchanged lumps of the materials. This biscuit was also very provocative of indigestion. Soon manufacturers began to make powders containing the ingredients combined in proper proportions, and the new article met with ready sale. It is probable that the first baking powder was a preparation of acid phosphate of lime and bi-carbonate of soda, the two ingredients being sent out in separate packages, accompanied with two small measures of different sizes—one for the acid, the other for the alkali. Then these articles were put up in packages, to be mixed with a certain weight of flour. Soon the attempt was made of combining the acid and the alkali in one package, but it was soon ascertained that the elements acted on each other, and the powder, when used in flour, had no value. Now it was discovered that if starch or flour were mixed with the two elements at the time of packing, the action between the two substances would be partially, and sometimes wholly, arrested. Hence to-day it is the custom to add starch or flour at the time of manufacture. This is called the "filler," and is necessary for the preservation of the powder; but it need not exceed 20 per cent.; more than that being fraudulent.

The manufacture of powders composed on the one hand of cream of tartar and bi-carbonate of soda, and on the other of acid phosphate and bi-carbonate of soda, went on for years, and the product was considered healthful under certain circumstances and when used occasionally. The high price of the cream of tartar led some manufacturers to try other articles that would act on the bi-carbonate of soda and liberate the carbonic acid. And soon powders containing alum, in one or another form, as the acid element, appeared on the market, the proper inquiry as to the healthfulness of the substance or its action on the digestion not being at that time instituted, or before the introduction of the new preparation, the sole element of cheapness obscuring all other questions for the time. Of late years this question has been raised, and the discussion is quite amply noted in the report of Professor Cornwall.

The success of many in this business of manufacturing baking powders has led others to try their skill in compounding all kinds of mixtures, and to-day the different brands of powders on sale in the shops are so numerous as hardly to be counted. It is our purpose to inform the public what the ingredients of these powders are, and what the value of the preparation really is. This has been done by Professor Cornwall, and the reader can see at a glance which powder has a high leavening power and which contains hurtful ingredients.

Let us now glance at the chief combinations, and investigate the true value of the powder.

As was stated above, the object of the baking powder is to take the place of yeast; this, we have seen, it cannot do in all particulars, but the main point it can accomplish, that is, generate carbonic acid gas. A baking powder should answer to all of the following requirements:

1. It should generate the maximum amount of gas.
2. It should contain no unhealthful ingredients.
3. It should leave in the loaf no unhealthful residue.
4. The elements should be combined in such proportions that the residue is neutral in reaction.

1. What is the amount of carbonic acid gas necessary to give the loaf a maximum of lightness? Unfortunately, this question has not been definitely settled, for no experiments have been made in this direction. The nearest approach to a solution of the problem is recorded by Jago, in his Treatise on the Chemistry of Wheat, Flour and Bread. He found that one-eighth of an ounce of compressed yeast, placed in a sugar mixture, and maintained at a uniform temperature of 80° F., for nine hours, evolved nearly 155 cubic inches of carbonic acid gas. From other experiments by the same chemist, in this line, I infer that the usual quantity of compressed yeast used in one quart of flour would give about 140 cubic inches of this gas; but this is conjecture.

All baking powders are made to be used in quantities equal to two teaspoonfuls; this is an uncertain amount. I found in my own kitchen that two heaping teaspoonfuls, or three "scant" spoonfuls, equaled about 12.5 grammes, or about 196 grains. This quantity of one of the popular cream of tartar powders would give about forty-nine cubic inches of carbonic acid gas.

As this point is not definitely settled, we are compelled to rely on the appearance of the biscuit made with the powder. If the product is light and flaky, and well made, it is probable that the gas has been evolved in sufficient quantities. We rarely, or never, obtain the vesiculated appearance characteristic of yeast-raised bread.

Another point to be considered is the rapidity with which the powder gives off its gas. It may give off all of the gas immediately on mixing, and before the bread is placed in the oven, or all may be generated in the oven; but it is probably best to have a portion generated on mixing the dough and another portion in the oven. This is accomplished in nearly all well-made powders.

It will be noticed in the table given in the report of Professor Cornwall, that a great many of the powders analyzed by him are very deficient in strength, that is, they are incapable of generating a sufficient quantity of gas. This is due to several causes; first, the ingredients may be combined in the wrong proportion, and as a result the bread contains a quantity of hurtful substances, hence the bread is heavy besides having these foreign materials in it. Secondly, the powder may have been badly protected against changes, and the ingredients have acted on each other before the can was opened. Thirdly, the materials used could not, by their chemical composition, generate the proper amount of gas. The result of these deficiencies is heavy and indigestible bread, and a person using these poor powders and not obtaining good results is tempted to add more of the powder at the next baking, thus loading the bread with the ingredients of the powder. In selecting a powder we should be guided by its power to produce a sufficient quantity of gas, and (other things being equal, and the ingredients being healthful,) the powder giving the greatest amount of leavening gas is the most economical. It is quite certain that any powder generating a less amount of gas than 10 per cent. should be rejected.

2. The powder should contain no unhealthful ingredient. It may be stated once for all, that all powders contain bi-carbonate of soda as the source of the carbonic acid gas; it is only in the acid element that they differ. The following substances are used to liberate the gas from the bi-carbonate of soda: bi-tartrate of potassium or cream of tartar, acid phosphate of calcium, alum in various forms, tartaric acid, and a mixture of these articles. Rarely, citric acid is used.

Taking these in the order given, it may be stated that there is no question concerning the healthfulness, in the quantities ordinarily used, of cream of tartar and the pure acid phosphate. Concerning alum there has been and still is doubt in the minds of many chemists and physicians, and the evidence seems to be conclusive that this article is not always healthful, hence the person who wishes to obtain a baking powder of undoubted character will not select one containing alum or any of its preparations. I state the point thus, thinking it best that all should base their opinions on the evidence that is given in Professor Cornwall's paper.

A word may be said about the impurities found in the ingredients themselves, for many of them are often imperfectly prepared. As to cream of tartar, there is now no difficulty in obtaining an article at least 99 per cent. pure. The acid phosphate is often contaminated with sulphate of lime. Alum contains the ordinary impurities, and in the case of burnt alum, iron is found in quantities, at times.

3. The powder should leave no unhealthful residue in the loaf.

The residue in the case of cream of tartar powders is tartrate of soda and potash, and the quantity in an ordinary loaf made with two teaspoonfuls of the powder amounts to about 100 grains, of which a person would take less than fifty grains in his portion of the bread.

This amount is not only harmless, but is positively innocent, and was always so considered until baking powder literature endeavored to create a doubt concerning this residue.

The residue left from the acid phosphate is composed of the phosphate of lime and phosphate of soda, two substances present in our food and in our tissues, hence these salts may be considered as perfectly healthful.

The residue from the alum powders depends on the form of alum used, and also on the solubility of this residue in the fluids of the body. It is now conceded that a portion of these alum residues is soluble in the gastric juice. Pitkin (*Jour. Am. Chem. Society*, Vol. IX., No. 2,) states that he thinks that at least one-sixth of the residue is soluble in the stomach and mouth. Mallet (*Chemical News*, Dec. 7th and 14th, 1888,) states that a part of the aluminium unites with the acid of the gastric juice and is taken up into solution, while at the same time the remainder of the aluminium hydroxide or phosphate throws down in insoluble form the organic substance constituting the peptic ferment.

This evidence is conclusive and certainly points to these facts: that alum residue does affect digestion, and that these residues are more or less soluble and are carried into the system. Hence, it is suggested that if any person wishes to avoid a possible danger to health he should refuse to buy alum powders. It must be stated, however, that the evidence in the case is not as strong as with other chemical agents, and we cannot speak of the results following the constant ingestion of small quantities of the soluble alum compounds with the certainty that we do when considering lead and other toxic agents, which are poisonous when taken in very minute quantities and continuously.

All that I can do officially, while there is yet doubt on this question, is to give the public the benefit of that doubt, and advise the use of these preparations with great caution until the problem is positively settled by experiments on the lower animals. As will be seen by reading Professor Cornwall's paper, some alum combinations are known to be dangerous to health; these he has indicated.

4. The elements of a baking powder should be combined in such proportions that the residue is neutral in reaction. In other words, there should be neither an acid nor an alkaline residue. If more of

the bi-carbonate of soda is added to the powder than is necessary to saturate the acid element, the bread will contain an excess of that substance. It is well known that an alkali taken into the stomach before eating will stimulate the secretion of the gastric juice, but if taken at meal-time or after eating, the reverse effect is noticed and the secretion is neutralized and also checked. Disordered digestion also results. The use of the mixtures formerly prepared in the home and made very carelessly was no doubt the cause of much illness.

In closing I shall only mention as a word of caution that baking powders sold by weight and without any name on the package are to be avoided, as any manufacturer responsible for his preparations will not be ashamed to print his name on the label.

COMPOSITION AND COMPARATIVE HEALTHFULNESS
OF THE
BAKING POWDERS SOLD IN THIS STATE.

BY HENRY B. CORNWALL, PH.D.,

Professor of Analytical Chemistry, John C. Green School of Science, Princeton College.

INTRODUCTION.

Although nothing is so well adapted as yeast for making a palatable and digestible bread, yet their greater convenience or the necessities of the case may sometimes be a reason for using baking powders even for making bread, and they are very largely used in preparing various articles of food which largely take the place of bread. It becomes, therefore, a very important question to determine the probable effects of the many different kinds of baking powders on the health of the consumers.

With this object in view, the investigations described in the following pages have been undertaken by the writer, at the request of the State Dairy Commissioner. All of the samples herein referred to have been bought in open market, and were sent to the analyst by the Commissioner or his assistants.

It was expected that there would be, among the many different brands, great differences in quality and much variety in composition, but in this latter respect the variations have exceeded expectation. The indications are that nearly everything ever known or reported to have been used in baking powders has been employed in preparing one or another of our samples; and there is also plain evidence that, through ignorance of their chemical properties, some of these mixtures have been compounded in such a way as to greatly increase the extent of any bad effect of other ingredients of the powders, while at the same time the substances thus unfortunately used are, for the most part, in themselves evidence of the best intentions on the part of the makers.

ACTION OF BAKING POWDERS.

The baking powders render the bread* light, through the action of gas set free in the dough. This gas is almost exclusively "carbonic acid gas," the "carbon dioxide" of the chemist. The carbonic acid is set free from bi-carbonate of soda by the action of some acid substance, which yields a part or the whole of its acid to the soda, thereby expelling the carbonic acid.

Carbonate of ammonia has been to some extent employed. This substance is solid at ordinary temperatures, and is converted into gas by the heat in baking, but is not alone suitable for a baking powder, because it may easily remain to some extent in the bread after baking, imparting to it not only an unpleasant taste; but possibly, even probably, unwholesome properties, which will be again referred to.

Formerly, the cook made the baking powder, when needed, by mixing in due proportions the two salts commonly used—cream of tartar and bi-carbonate of soda. The cream of tartar (bi-tartrate of potash) contains more of the tartaric acid than is necessary to neutralize the potash in it, and this excess of acid liberates the carbonic acid from the bi-carbonate of soda. The reaction takes place only when the two salts become dissolved in the dough, and these salts were especially adapted to the purpose because they dissolve but slowly, so that there is a continual and gradual liberation of the gas, keeping the bread light until the baking is finished. Bi-carbonate of soda is better than simple carbonate, also, because it yields twice as much gas.

There were serious objections to the old-fashioned process. Apart from impurities in the salts, which are quite as prevalent in some of the modern baking powders, the cook needed to exercise unusual care in measuring the two salts, so as to avoid getting too much of one or the other, and quite as great care was needed to thoroughly mix the two, so that they might exercise their full action on one another, without which the familiar yellowish or brownish "soda" spots would be produced. A really well-made baking powder obviates all the evils resulting from these causes, as well as from the use of impure or deteriorated materials.

---

*For convenience, the term "bread" will be used to include any articles made with baking powders.

The requisites of a good baking powder are:

1. That the ingredients, in the quantities used, shall not injure the health of the consumer.
2. That the powder shall yield the largest amount of gas that can be obtained from wholesome ingredients, and in such a way as to produce the best effects. Boiled with water, it should give a neutral, or very nearly neutral solution.
3. That the powder shall keep its strength, and also not cake or become lumpy under the ordinary conditions of storage and use.

The caking of the powder is due to the fact that some of the active ingredients are often of such a nature as readily to absorb moisture from the air, so that they partly dissolve, and not only cause caking but also loss of "strength" through the escape of carbonic acid gas. This evil is greatly reduced by the use of well dried materials and by the addition of dry starch powder, wheat flour or similar farinaceous substance, so that a well made powder loses very little strength. In good cream of tartar baking powders, about 20 per cent. of such a "filling" body is often used. More than this is unnecessary and simply lowers the cost of the product. A little less is sometimes used. In the majority of alum powders the strength is only one-third or one-half what it might be, and in many cases this is, no doubt, due to excess of the starch or flour thus sold at the price of baking powder. It may be argued that the strength of the powders is purposely kept down to a standard that will permit the use of the customary "two teaspoonfuls."

NECESSARY QUANTITY OF BAKING POWDER.

The calculations that follow refer to powders made of pure ingredients, with nothing else but a starch or flour "filler." It must be understood that there is no legal standard for baking powders. Any wholesome materials may be used, and the only requirement with regard to strength would be that the powder should give a light enough bread without needing to be used in injurious quantities.

Moreover, the statements on labels that a powder "is made from pure ingredients" has little significance, unless the ingredients of the powders are also given. An alum powder may be made of pure alum; a mixed powder may contain pure bisulphate of soda and pure tartaric acid; even an acid phosphate of lime powder may be made of pure materials, so far as concerns the addition of any adulterant by the compounder, and yet the acid phosphate may be full of sulphate of lime, originally present in it by the nature of the process of manufacture. Thus, a maker of baking powder might be sending out an article containing much *terra alba* (sulphate of lime), and yet, because he knew he had not put in any terra alba as such, he would claim that his powder was pure.

Apparently, cream of tartar powders cannot be made to keep well if beyond a certain strength, ranging from 13 to 14 per cent. of carbonic acid gas. Alum powders could be made twice as strong, but they are not; the very object of using alum being to lessen the cost of manufacture. Very many alum powders in the market cannot be profitably used, on the score of cost, when their strength is compared with that of the better grades of cream of tartar and phosphate of lime powders.

As will be seen from the results of our analyses, the higher grade cream of tartar powders average about 12 to 13 per cent. of carbonic acid gas, while the higher grades of alum powders give about 10 per cent. In almost every case the directions are to use two teaspoonfuls to the quart of flour. These directions are purposely left somewhat to the discretion of the cook, and it is difficult to determine the actual weight likely to be taken in any given case; more particularly because the density of the powders varies greatly. In the writer's kitchen two teaspoonfuls was found to be from 235 to 275 grains of an alum powder. Others have found the equivalent of two teaspoonfuls to be from 200 to 250 grains; others again report 210 grains (these being "moderately heaped spoonfuls.")

The writer had a loaf of bread made with a quart of flour and 200 grains of a burnt ammonia alum baking powder (made by himself from some of the best material found in the trade), whose strength was about 13 per cent. of carbonic acid. He also had another made with 230 grains of the baking powder No. 22 (see list of analyses). The bread in the second case was lighter than in the first, but was decidedly "heavy." At least 250 grains of either of these powders would have been needed to make a passably light loaf.

We shall uniformly assume that we are dealing with a powder yielding 10 per cent. of carbonic acid, and that 210 grains of the powder will be taken for a quart of flour. In fact, the cook would use whatever seemed to be a sufficient quantity, and with low grade powders this will mean more than with high grade. The figures we shall arrive at as representing the residues in the bread will probably be 20 per cent. below the truth in four-fifths of the cases that would arise in actual practice, and often nearer 50 per cent. below.

It will be well, also, to state once for all, to make the comparisons simpler, whatever the acid principle may be, that we shall take bi-carbonate of soda as the source of the carbonic acid gas, and that 210 grains of a baking powder yielding 10 per cent. of this gas will contain 40 grains of bi-carbonate of soda, chemically pure. We shall also assume that 210 grains of each powder will be used to make a loaf of bread from one quart of flour, the loaf weighing about one pound and three-quarters.

CREAM OF TARTAR POWDERS.

To decompose 40 grains of bi-carbonate of soda requires 89.5 grains of cream of tartar. After the carbonic acid gas has been expelled, there remains in the bread 100 grains of the double tartrate of potash and soda—the drug known as Rochelle salts. Most exaggerated statements have appeared in the newspapers relating to the physiological action of this salt, but it is one of the mildest used in medicine, and its taste is comparatively feeble. Stillé and Maisch (National Dispensatory, 2d edition,) say: "In doses of one-half ounce to one ounce (240 to 480 grains) it acts as a gentle and cooling laxative, and seldom disagrees with the stomach." As a purgative, the dose is one ounce. It is the active principle of the seidlitz powders, so often taken as a mild form of medicine.

The cream of tartar itself is a natural constituent of grape juice, and probably no material has ever been devised for making baking powders that is open to less objection than cream of tartar, unless possibly the acid phosphates.

In consuming the equivalent of half a loaf of our bread, one would take fifty grains of Rochelle salt.

ACID PHOSPHATE OF LIME POWDERS.

The acid phosphate of lime (also called superphosphate of lime) has of late been much used in baking powders, and there seems to be no physiological objection to its use. Indeed, it is claimed that its use restores to the finest wheat flour the phosphoric acid which is so necessary to our health, and which has been in great part removed with the bran.

When the acid phosphate acts on the bi-carbonate of soda there is formed phosphate of soda, soluble in water, and insoluble phosphate of lime, the latter being, however, more or less soluble in the various fluids of the digestive organs. The acid phosphate is well adapted for baking powders, because it liberates a part of the carbonic acid quickly and the rest only on heating. There being no controversy as to its harmlessness, we will not discuss the subject. Being a very hygroscopic substance, the acid phosphate powders need to be very carefully prepared and secured from moist air, or they will rapidly deteriorate.

Other acid phosphates have been to some extent employed, but the acid phosphate of lime far the most widely.

Unless properly prepared, the acid phosphate may not be so unobjectionable a substance. It is made by acting upon ground bones with sulphuric acid. The result is sulphate of lime and the acid phosphate of lime. If now the latter, which is freely soluble in water, is leached out, leaving the sulphate of lime behind, we have the acid phosphate in fit condition to be used. It is mixed with starch, dried and brought into the market as a cream of tartar substitute.

Frequently, however, the sulphate of lime is left with the acid phosphate, and will then bring about any ill effects that may justly be attributable to the sulphate. Moreover, unless the sulphuric acid used has been carefully purified, it may bring no inconsiderable quantities of lead and even arsenic into the baking powder.

No examinations of our baking powders for lead or arsenic were made, and the writer has no desire to arouse any unfounded fears, but simply to point out to the makers of baking powders the caution necessary in this respect. If time permits, such examinations will be made and the results given in an appendix to this report.

BISULPHATES OF POTASH AND SODA.

Bisulphate of potash has been, to some extent, used in baking powders. Its ready solubility would render it unsuitable for use alone, but when used, it has probably been for the purpose of securing a more rapid liberation of carbonic acid at first. Used with bi-carbonate of soda, it leaves a residue of sulphate of potash and sulphate of soda, and the sulphate of potash is a very objectionable substance, if present in any considerable quantity. Stillé and Maisch say of it: "Formerly used as a purgative. It is so in smaller doses than other salines. Its action is apt to be harsh and burning in the abdomen." The dose is one-fourth to one-half ounce.

The sulphate of soda (Glauber's salt) is also an active purgative, very little used in England or in this country for administration to human patients, but it is used in Germany very largely in place of our more commonly employed sulphate of magnesia (Epsom salts). The dose of sulphate of soda, as a purgative, is one-half ounce to one ounce, from which it appears that it is a much more active drug than Rochelle salt.

Bisulphate of soda has been used in baking powders, in combination with other acid principles. Its action on bi-carbonate of soda results in a residue of sulphate of soda. The effects of such a residue will be referred to under alum powders.

SESQUI-CARBONATE OF AMMONIA.

Carbonate of ammonia used in small quantities, is perhaps unobjectionable, but probably if any considerable quantity were employed, disagreeable physiological effects might be expected, irrespective of the unpleasant odor and taste that the ammonia compounds would impart to the bread, which always shows ammonia reaction, even when small quantities only were used in making it. The ammonia salts in general appear to be much more irritating and stimulating than the corresponding soda, or even potash salts. Stillé and Maisch say of carbonate of ammonia: "It is irritant, and if long continued, even in doses which the stomach will tolerate, it impairs nutrition." In doses of five to ten grains, it increases the fullness and force of the pulse, and causes a sense of tightness in the head. It is a very powerful agent. The ordinary dose is two to ten grains. Evidently, such a substance needs to be used with care in preparing foods.

ALUM BAKING POWDERS.

Of late years the alum baking powders, being more cheaply made, have come into extensive use, and have met with considerable opposition on the score of qualities alleged to be injurious to the health. The writer will endeavor to present the question in a fair way.

The alum used in this part of our country is now almost exclusively burnt ammonia alum; and since the potash alum is more expensive, the same is probably true of alum baking powders in general.

The crystallized alums are less frequently employed, because they are too easily soluble; but they may be used in connection with the burnt alum, to secure at first a more rapid escape of carbonic acid gas. "Burnt alum" is alum deprived of its water of crystallization by gentle heating, and it dissolves, but very slowly, in cold water.

To decompose 40 grains of bi-carbonate of soda requires 38.1 grains of burnt ammonia alum. The residue contains very nearly the equivalent of 8 grains of dry ("anhydrous") alumina, nearly equal to 72 grains of crystallized ammonia alum, or 74 grains of crystallized potash alum (ordinary alum).

The alumina is present in the bread, partly as hydrate and partly as phosphate of alumina, in case simple alum baking powders are used. Where acid phosphates are also used in sufficient quantity, the alumina remains in the bread as phosphate.

A great deal of testimony for and against the use of alum in baking powders might be collected, but it seems better to confine our attention to the comparatively few published statements that rest on experimental evidence.

Although now possessing mainly a historic interest (because more is now known about the action of alum baking powders, and because their composition is now generally different from the one in question), the celebrated English case, known as the Norfolk baking powder case, will here be reviewed.

The advocates of alum powders at the present day have made much use of some of the testimony given in this case; a very full report of which will be found in the *London Analyst*, December, 1879, and January, 1880.

The real defendants in the case were the makers of the powder, and they were successful in their appeal.

The medical and chemical evidence was conflicting. No statements will be repeated in this abstract which were not supported by actual experiments, made by the witnesses or other experts.

One prominent question in the case was whether the phosphoric acid naturally present in the bread, and so useful to the human system, was rendered insoluble by combination as phosphate of alumina, and thus kept from assimilation. The prosecution contended that it was; the defense, that practically it was not. Facts now in our possession indicate that the prosecution was not wholly in the right, and the entire question is of less importance in considering alum powders combined with acid phosphate of lime, since these bring into the bread an additional quantity of phosphoric acid.

For the prosecution, J. West Knights, Public Analyst, testified that a four pound loaf of bread, made according to the directions, would contain the equivalent of 118 grains of crystallized alum. From his experiments he concluded that the powder would render the gluten and the soluble phosphates of the flour insoluble. There would be less soluble phosphates by seven-tenths. He believed phosphate of alumina was not soluble in the gastric juice, but that was a question for a physiologist and not a chemist. The effect of either hydrate or phosphate of alumina would be to harden the gluten.

M. M. Pattison Muir, Expert Chemist, for the prosecution, found four times as much soluble phosphoric acid in yeast-bread as in bread made with this powder. He also found that gluten acted upon by a mixture like this powder was 20 per cent. less soluble than gluten from flour not so treated. He tested the solubility by hydrochloric acid of two-tenths per cent. strength for fifty (?) hours, making his experiments on the assumption that the gastric juices are equivalent to a weak solution of hydrochloric acid.

Dr. J. B. Bradbury, Lecturer in Physic at St. John's College, testified that if people were chiefly to live upon bread made with this powder it would have a deleterious effect. His opinion would be modified if satisfied that the phosphates were not indigestible in the stomach.

Dr. Paget, Professor of Physic in the University of Cambridge, would not venture to say that bread made with baking powder (this powder?) was an article of food injurious to health, except in the case of persons of weak digestion.

For the defense, Francis Sutton, Public Analyst, testified that in a two pound loaf he found three grains of anhydrous alumina, due to this baking powder. (The makers of the powder admitted that it contained about 33 per cent. of crystallized alum, not stating whether potash or ammonia alum. The directions required one teaspoonful to a pound of flour, and Mr. Knights gave the average teaspoonful of it as 150 grains.) Mr. Sutton's practical experience with the powder for Norfolk dumplings, in his own family, for some years, showed no prejudicial effect. From personal experience, he did not agree that it hardens gluten and makes it indigestible. He did not believe the powder would form phosphate of alumina, and if formed it would be soluble in the gastric juice. He fed pigs with bread made with the baking powder. They throve well, and when killed their "internal appearances" were perfectly healthy. He analyzed the contents of their bowels, and his inference from the results was that, if phosphate of alumina was formed, the gastric juice took from it all the phosphoric acid required, leaving the hydrate of alumina to be rejected with the fæces. He objected to Mr. Muir's experiments on the gluten and phosphates, because not made under the conditions existing in the stomach.

Dr. C. M. Tidy, Professor of Chemistry and Forensic Medicine at the London Hospital, testified for the defense. He knew, as a matter of fact, that the phosphate of alumina is soluble in the gastric juices, and that when in solution of that nature with the membrane between and the alkaline blood on the other side, the whole of the phosphoric acid filters through into the blood. He thought that the use of this powder was not injurious.

Dr. F. W. Thudicum, having heard the evidence, thought there was nothing injurious in the use of this powder.

After the above brief outline of the evidence one is not surprised to learn that the judge refused to convict the defendants of an offense rendering them liable to a fine of £50; but since this trial several important facts have been brought to light.

J. W. Knights (*London Analyst,* 1880, p. 67,) made the following experiments: Two grammes (about 31 grains) of gluten prepared from wheat flour was boiled ten minutes with:

1. Pure water.
2. Weak solution of alum.
3. Weak alum and carbonate of soda solution, with the resulting precipitate of hydrate of alumina.

4. Weak alum and phosphate of soda solution, and the resulting precipitate of phosphate of alumina.

After washing with water each sample was digested with "artificial gastric juice" (pepsin and 0.2 per cent. hydrochloric acid) at a temperature of 90° to 96° Fahr., for five hours. The experiments were repeated with lactic acid instead of hydrochloric, with similar results.

No. 1 had entirely disappeared.
No. 2 left 1.05 gramme of residue, tough and spongy.
No. 3 left 0.9 gramme of similar residue.
No. 4 left 0.8 gramme of similar residue.

He thought it fair to infer that the solubility of gluten treated either with alum or with insoluble salts of alumina, is less soluble by one-half than ordinary gluten in gastric juice.

He found yeast bread to be one-third more soluble in this artificial gastric juice than bread made with an alum baking powder. He also tried the effect of alum upon diastase by digesting one sample of crushed malt, with no alum, and another with 10 per cent. of alum in water at a temperature of 160° F., for one-half hour. The pure sample gave nearly four times as much extract as the other. He adds: "This experiment shows that alum exerts a very marked influence on the conversion of starch by diastase. As diastase is similar in its action to, and supposed to be identical with ptyaline, the ferment of saliva, I think this has a direct bearing upon the indigestibility of alumed bread, for not only is the gluten of the bread, but also the starch, rendered much more indigestible by the presence of alum. This powerful action of mere traces (?) of alum, or salts of alumina, upon soluble gluten and diastase is, I think, sufficient foundation upon which to assert that alum, either in a soluble form or mixed with carbonate of soda, is injurious to health when introduced into bread. The extent of the injury may or may not be small."

L. Pitkin (*Journal American Chemical Society*, IX., 27,) reports that he made a baking powder containing 14.9 per cent. each of ammonia alum and acid phosphate of lime, with 21.6 per cent. of bi-carbonate of soda, and the rest corn starch. With two moderately heaped teaspoonfuls of this (13.615 grammes = 210 grains, nearly,) to a quart of flour he made biscuit, weighing 818 grammes and containing 499.2 milligrammes of anhydrous alumina. He subjected sixty grammes of this biscuit, containing 36.6 milligrammes of alumina, to the action of gastric juice after the biscuit had been chewed to mix it with saliva. The gastric juice was obtained from a healthy living dog. After being exposed to the action of 200 grammes of the gastric juice (the quantity probably present in such a case in natural digestion) for three and a half hours at a temperature of 99° Fahr., it was found that one-third of the alumina had been dissolved. So far the actual experiments. He gives reasons for thinking that possibly in human gastric juice only one-sixth to one-fifth might have been dissolved. Mr. Pitkin's baking powder contained nearly the same quantity of alum as would be necessary to yield, by its action on bi-carbonate of soda, the 10 per cent. of carbonic acid gas which we have been heretofore taking as the average strength. We may therefore make our calculations on the same basis as hitherto. To decompose forty grains of bi-carbonate of soda requires 38.3 grains of burnt ammonia alum. The residue will contain very nearly 34 grains of sulphate of soda, 10.5 grains of sulphate of ammonia, and 8 grains of alumina. If only one-sixth of the alumina is dissolved, a man consuming one-half of one loaf of bread made from one quart of flour, would have in his digestive organs in a soluble state, 1.36 grains of alumina, nearly equivalent to 12 grains of crystallized ammonia alum. Taking the higher figure of one-third actually found by the experiment, there would be dissolved the equivalent of about twenty-four grains of alum, or more than half of the maximum dose of this salt, unless an emetic effect is sought. It remains with the advocates of alum powders to reconcile this result with their assertion that the alumina is present as insoluble alumina, and "as harmless as a few grains of white clay or any other inert material." Our quotation is from a little pamphlet containing what appears to be a reprint from an article by C. V. Petraeus, chemist, in the *Pharmaceutical Record*, June 1st, 1888. We quote further from Mr. Petraeus: "If alumina were soluble in the gastric juice the case would be different; but the most careful experiments by men thoroughly qualified for such work, prove that the alumina resulting from the use of alum baking powders is absolutely without action upon the stomach and intestines, and is ejected from the system in the solid excrement."

Probably this refers in part to Mr. Sutton's experiments with pigs in connection with the Norfolk baking powder case, but no proof was there offered that the alumina had not been in solution; simply that it was ejected with the contents of the bowels. In fact, the prosecution contended (wrongly, so far as we now know) that the phosphate of alumina was insoluble, while the defendants (for the makers of the powder) contended that it dissolved in the gastric juice.

It may be that the experiments of Prof. G. E. Patrick, Professor of Chemistry in the University of Kansas, are also referred to (*Scientific American Supplement*, No. 185). We give an abstract from the original article:

> "The practical question is, Will the hydrate of alumina, as it exists in bread after baking, be dissolved in the fluids of the alimentary canal? This question is important, for, if dissolved, it might produce in some slight degree (why slight?—H. B. C.) the effects ascribed to alum; but if it is not dissolved such effects are impossible, and alum, used properly as an ingredient of baking powder, may be considered as harmless. But with the diversity of opinion that is seen to exist regarding the acid of the gastric juice, *a priori* reasoning is of little value; direct experiment can alone be trusted for a reliable answer. With the view of settling the question beyond dispute, I have, during the last two months, carried on a series of experiments upon living animals. The results obtained, so far as the kind of animal and the kind of powder employed are concerned, are, I think, conclusive. * * * The experiments were made with cats, and with a well known alum powder."

Biscuits were made by Prof. Patrick with three teaspoonfuls of powder to one-half a pint of flour—six times the quantity usually employed and twelve times that directed on the label.

Half a dozen biscuits were baked in each batch, and one to one and a half fed to a cat that had fasted for one or two days; this gave at least half a teaspoonful of powder for the actual experiment.

After allowing various times for digestion, the cats were killed and the entire contents of the stomach and small intestines were examined for dissolved alumina.

The time allowed for digestion varied from twenty minutes to two and one-half hours, and in five experiments not a trace of dissolved alumina was found.

Again, two teaspoonfuls of the powder were mixed with water, baked at the ordinary temperature of the oven and the whole fed to a cat (under compulsion), allowed to digest and the contents of the stomach and intestines examined for dissolved alumina. In two experiments none was found, the time of digestion being from one and one-quarter to one and three-quarter hours. From this he concludes that hydrate of alumina, when baked, is not dissolved by the juices of the alimentary canal.

Again, he simply boiled two teaspoonfuls of the powder with water and fed the mass to each of two cats. After digestion for one and two hours respectively, he found traces of dissolved alumina. He concludes, from these two experiments, that the gelatinous hydrate of alumina, moist and unbaked, is dissolved to a very slight extent in the digestive fluids. Hence, he adds, the public is advised not to eat bread in the dough; it should be always baked. (Prof. Mallet's experiments, given in a later part of this paper, prove that the alumina, in a loaf of bread at least, is in the condition of Prof. Patrick's hydrate.—H. B. C.) He further made experiments in which the baking powder was purposely so mixed with the flour that part of it should remain nearly or quite dry. In this case, as he expected, the alum was not all decomposed in baking, and he found a trace of dissolved alumina in the cats' stomachs. This he regards as indicating simply that to insure entire absence of alum in the bread the mixing should be thoroughly done.

His conclusion, from all these experiments, is, "Assuming that the human digestive fluids act in about the same way as do those of the feline race—and I believe that assumption has always been made—it seems to me established, as well by experiment as by reason, that a properly made alum baking powder, as used in making bread or biscuit, is perfectly harmless to the human system."

Professor Patrick, in closing, states that his investigation was undertaken for the sole purpose of finding out the facts in this matter, that no parties interested in the sale or manufacture of baking powder had any knowledge of the investigation, and that he has received no remuneration for it or for his article.

With regard to Professor Patrick's trials with the biscuits, the results are in conflict with the experiments of Mr. Pitkin, which were carried out in apparently a proper way, the biscuit having been in this latter case masticated and thus mixed with human saliva before being exposed to the action of genuine canine gastric juice. Mr. Pitkin found that the alumina was dissolved in a very considerable quantity and the negative results with Professor Patrick's cats simply show that in their case there was no such solution. It may fairly be questioned whether there was any true digestion of the biscuits in the stomachs of the cats, since the dough was prepared with such a large excess of baking powder (twelve times as much as the directions declared to be necessary) that very possibly the presence of so large a quantity of mineral salts may have suspended the operation of digestion. Professor Patrick gives no information as to the condition of the cats' stomachs after death, nor as to the apparent extent of actual digestion of their contents.

Again, his experiments were directed solely toward ascertaining whether any alumina was in solution, and throw no light on the very important question as to the effect of alum baking powders on the digestibility of the biscuits or bread. Mr. Knights' experiments, already alluded to, and those of Professor Mallet, which will presently be given, indicate that the digestibility of the bread is itself lessened by the presence of the alumina compounds, whether soluble or insoluble.

Finally, Professor Patrick found that at least a little alumina was dissolved, when present in the stomach as hydrate, and Professor Mallet proves that in baked bread it is present in that condition.

It does not seem to us that these experiments of Professor Patrick justify his conclusions when compared with the experiments of Mr. Knights and Professor Mallet.

The advocates of alum powders point to the fact that cream of tartar baking powders leave nearly twice as much residual matter as a pure alum baking powder of the same strength. But the properties of these residues are different. Sulphate of soda is a more active salt than Rochelle salt, being purgative in doses of one-half to one ounce. Probably there is little to choose between the two kinds of baking powder, so far as the residues of Rochelle salt and sulphate of soda are concerned.

It is possible, however, that too little attention has been paid to the presence of ammonium salts in the residues from ammonia alum powders. Mr. Petraeus asserts (*loc. cit.*) that the action of sulphate of soda and sulphate of ammonia is rather milder than that of tartrate of soda and potash. As regards the sulphate of soda, the authorities to which we have access do not confirm the statement; while as to sulphate of ammonia, we can find no special statement, because it is not used as a medicine.

We do know, however, that ammonia salts, in general, are much more irritating and stimulating in their action than the corresponding soda salts, or even than the potash salts. For instance, Stillé and Maisch, speaking of ammonium bromide, state that it has a more acrid taste and is more irritating than potassium bromide. Its unpleasant taste and irritating qualities render it less convenient for administration than the bromide of potassium.

We all know how mild a substance is chloride of sodium (common table salt); but of ammonium chloride, Stillé and Maisch write: "The direct effect of doses of 5 to 20 grains of this salt, repeated at intervals of several hours, are a sense of oppression, warmth and uneasiness in the stomach, some fullness in the head. If it is used for many days together in full doses, it disturbs the digestion, coats the tongue and impairs the appetite." We have already seen how active a drug carbonate of ammonia is, and while, in the absence of proof, it would be rash to assert that sulphate of ammonia in five grain doses is certainly injurious, yet there is abundant ground for further investigating its effect before asserting that it is milder in its effects than Rochelle salt. It may be that this question of the presence of ammonium salts in any considerable quantities in the residues of baking powders, deserves more attention than it has hitherto received.

PROF. MALLET ON ALUM IN BAKING POWDERS.

A very important contribution to our knowledge of the alum baking powders and the effects upon digestion of their residues in bread, has been very lately made by Prof. J. W. Mallet, of the University of Virginia. It is published in the *Chemical News*, December 7th and 14th, 1888, from which we abstract the following important points.

In the solutions obtained by acting with water on the baking powders, he in some cases found alumina in the solution, equivalent to 7.72 grains of crystallized ammonia alum per ounce of baking powder; possibly due to the presence of a small amount of organic matter. (As we shall see later, some alum powders may yield very much of their alumina to water solutions, owing to the presence of tartaric acid or tartrates.) In the mixed alum and acid phosphate of lime powders he found nearly the whole of the alumina as phosphate, after treatment with water.

By experiments with a registering thermometer, he found the temperature in the center of loaves of bread to range from 197° to 212°

F. in various ovens whose atmosphere was heated from 472° to 496° F. during the baking, and he concludes that the hydrate and phosphate of alumina in the bread are never heated above 212° F. He prepared pure hydrate and phosphate of alumina by precipitation, and after drying them in air at the common temperature, heated them for an hour and a half to about 212° Fahr. in a slow current of air nearly saturated with moisture at the same temperature. He found that neither the "water of combination" of hydrate of alumina, nor the whole of the associated water of the hydrate or the phosphate was removed in this way.

He experimented on himself with both hydrate and phosphate of alumina thus dried, swallowing weighed quantities of one or the other, either ten or fifteen minutes before a meal, with a little water, or with the ordinary food at a meal. The quantities of hydrate varied from 10 to 50 grains, averaging about 28 grains; of phosphate of alumina, from 10 to 100 grains, averaging 45 grains. The doses were intentionally made larger than would be taken in the amount of bread usually eaten at a time, if the alum baking powder had been employed in the ordinary proportions, because the object was to ascertain with what doses distinct effects were noticeable. The effect seemed to be generally noticed with any dose of not less than 20 grains of the hydrate, or 40 grains of the phosphate.

While on one or two occasions, particularly with the smallest doses, there was no clearly observable effect, the general tenor of the experiments seemed to establish, beyond doubt on his part, the fact that the ingestion of the aluminum compounds produced an inhibitory effect on gastric digestion; while in some cases, particularly with the larger doses, and on the whole, rather with the hydrate than the phosphate, in equal weights, the interference with the course of digestion was very notable. There was no gastric pain, nor symptoms of gastric or intestinal irritation, but simply the well known oppressive sensations of indigestion, properly so called, lasting for a longer or shorter time, but generally for at least two or three hours after taking the food.

It may of course (we quote) be reasonably supposed that a considerably less quantity than would be necessary to produce decided discomfort when once administered, might prove objectionable and injurious if habitually taken as a part of the bread of each daily meal. With the proportion of alum in most baking powders in use, with the allowance of two teaspoonfuls (200 grains) of powder to a quart of flour, and assuming 35 to 40 per cent. of water in baked bread, a pound of bread would contain thirteen or fourteen grains of hydrate of alumina, if alum alone were used in making the powder, or twenty to twenty-one grains of phosphate of alumina, if alum and acid phosphate of lime were used together and all the alumina were left in the bread as phosphate—assuming the conditions of hydration shown by his experiments.

Professor Mallet also experimented on digestion of these alumina compounds with an artificial gastric juice, made by dissolving 2.5 parts of real hydrochloric acid and three parts of a pretty easily soluble "pepsin" in water enough to produce 1,000 parts of the liquid.

About fifty grains of the alumina compound was digested with somewhat more hydrochloric acid than would suffice for complete solution, at 98° to 99° F. for two to two and a half hours. He found that when hydrate of alumina was so treated, from 47.3 to 61.8 per cent. of it dissolved, while from 5.6 to 14.5 per cent. of the pepsin was precipitated from the solution. In the case of phosphate of alumina, from 38.2 to 49.1 per cent. of this was dissolved, while from 25.8 to 32.9 per cent. of the pepsin was rendered insoluble. Although the results are only approximate as regards the organic matter precipitated, yet it was clearly shown that both of the principal constituents of natural gastric juice were influenced; the hydrochloric acid being in part charged with dissolved aluminum, and some of the organic matter removed from the digestive ferment, pepsin. This double effect may be fairly taken to indicate impairment of digestive efficacy of the natural gastric juice under similar treatment.

Reasoning from the second of the above effects, although without direct experiments on the point, he judges it probable that precipitation of soluble albuminoid and other forms of organic matter of food would be brought about by the alumina compounds, which would enter into a more or less loosely united compound with the organic matter, somewhat as coloring organic substances are fixed by aluminum mordants in dyeing.

He regards it as a fair conclusion that not only alum itself, but the residues which its use in baking powder leaves in bread, cannot be viewed as harmless, but must be ranked as objectionable, and should be avoided when the object aimed at is the production of wholesome bread.

These experiments of Professor Mallet are conducted in the right way, and his conclusions are entitled to great weight. We might quote the decided opinions of many scientific men against the use of alum baking powders, but with the preceding facts before us, this phase of the question may be left while another very important one is taken up.

TARTARIC ACID AND TARTRATES IN ALUM POWDERS.

The makers of alum baking powders sometimes add tartaric acid or bi-tartrates to their powders, either with or without the addition of acid phosphate of lime. This is doubtless done with the best intentions, either to secure a more rapid escape of carbonic acid gas at the outset, or otherwise improve the powder. We have found such additions in the case of several of our samples, but the presence of tartaric acid or tartrates in alum powders is very objectionable. If added in sufficient quantity to otherwise pure alum powders, they prevent the precipitation of the insoluble hydrate of alumina entirely when the powder is boiled with water, and they may render much of the alumina soluble in water even after the bread is baked. Without doubt it would then be readily soluble in the digestive organs, producing there the effects due to alum or any other soluble aluminum compound.

With one of our samples we found that the simple water solution seemed to contain as much alumina as a nitric acid solution. In neither of these solutions could any of the alumina be thrown down by a slight excess of ammonia water, although it was readily precipitated from the solution first rendered alkaline with caustic soda, then slightly acidified with acetic acid and boiled with excess of phosphate of soda.

From bread made with this powder a soluble alumina compound was readily extracted with luke-warm water alone, in quantity sufficient to cause an abundant precipitate of phosphate of alumina when treated as above indicated. (See Appendix, page 92.)

The presence of acid phosphate of lime in the alum baking powder diminishes the evil effect of the added tartaric acid or tartrates, but the use of these or of any similarly acting organic compounds to decompose the bi-carbonate of soda, is always liable to render the alumina easily soluble in the bread.

Not even the boldest advocates of alum powders have denied the injurious tendencies of soluble aluminum compounds in the bread.

Makers of alum powders who may learn these facts will, it is hoped, avoid adding such substances to their powders. The addition of acid phosphate of lime, or some crystallized alum, or even bi-sulphate of soda, will equally secure the quicker evolution of the carbonic acid gas, without, at all events, furnishing additional objections to the use of alum powders.

ALUM AND ACID PHOSPHATE POWDERS.

It is a well established fact that many of the alum powders are very deficient in strength, and among our samples this is especially the case with the mixed alum and acid phosphate powders. It is quite possible that some of these powders, when put up, were of a fair strength, but they have deteriorated on account of premature reactions between the acid phosphate and the bi-carbonate of soda. The best acid phosphate of lime powders are very carefully packed in glass bottles with tight stoppers, or else the acid phosphate and the bi-carbonate of soda are kept in separate packages. Only by such care can the acid phosphate powders be successfully kept, and the same care is necessary to insure the keeping qualities of any powder containing a notable proportion of acid phosphate.

The addition of acid phosphate to alum powders can only be regarded as an improvement, provided the acid phosphate is free from sulphate of lime, lead or other objectionable substances, and the powders are put up in truly air-tight packages. Otherwise the deterioration leads to the use of larger quantities of the powder, and often with the result of introducing larger quantities of the alumina compounds into the bread.

METHODS OF ANALYSIS.

The analysis was directed toward determining the "strength" of the powders, or their yield of carbonic acid gas, and their composition, so far as to indicate the nature of the chief active constituents. No great importance was attached to the amount of starch or other legitimate "filling," which only has an effect on the strength of the powder, nor was it possible to examine so large a number of samples minutely as to the residues left by them. Especial attention was therefore paid to the presence of possible objectionable constituents of the residues, and to ingredients that might render the use of the powders injurious.

Carbonic Acid Gas.—This was determined with great care by boiling 1 gramme (15.43 grains) of the powder with 125 to 130 cubic centimeters (about 4¼ fluid ounces) of distilled water in a roomy flask, connected with a Classen's condensing, drying and absorbing apparatus (Classen, *Quantitative Chemische Analyse*, 1885), the carbon dioxide being absorbed in soda-lime tubes, of which there were two, having their further ends charged with carefully dried chloride of calcium. The contents of the flask were boiled, with proper use of a slow current of air, for one and one-half to one and three-quarters hours, and the current of air was kept up for half an hour after removing the flame, so that the whole operation lasted from two to two and one-half hours. Only in this way was the carbonic acid gas with certainty to be expelled from the somewhat viscid, starchy water solution and completely carried over into the absorption tubes.

Tested before the analyses were begun, with a sample of probably one of the best commercial bi-carbonates of soda in the market, the absorption apparatus yielded 51.38 per cent. of carbon dioxide; measurement of the gas (see below) indicating 51.44 per cent.

Tested in the course of the series of analyses by decomposing Iceland spar (crystallized carbonate of lime) with citric acid in the presence of starch, in the proportion used in the average of good cream of tartar baking powders, the absorption apparatus showed 43.83 per cent., theory requiring, for absolutely pure carbonate of lime, 44 per cent.

As a check analysis, when it could be properly done, the gas evolved from the powder by 10 c.c. of a mixture of 1 vol. of hydrochloric acid, spec. grav. 1.2, with 2 vols. of water, in a Scheibler's evolution bottle, was collected over mercury and measured, correction being made for atmospheric pressure, temperature and moisture, and also an allowance for the carbon dioxide retained by acid of the strength used, as determined by tests with Iceland spar. Enough baking powder was taken to give 90 to 110 c.c. of gas. The results by measurement averaged 0.12 per cent. below those by absorption and weighing of the gas, probably on account of the difficulty of liberating the gas, even by violent shaking, from the somewhat viscid liquid produced by the action of the strongly acid solution on the starch or flour. The greatest difference by the two methods was 0.29 per cent.

Whenever a sample showed a rather low percentage of carbonic acid gas, or left a decidedly alkaline solution, duplicate tests were made by the soda-lime absorption, and no dependence was placed on measurement, but in other cases it was a most convenient and reliable check on the other method.

Sulphates.—These were detected in the cold-water solution of the baking powder, bearing in mind the possible solvent action of citric acid on the barium sulphate. No attention was paid to minute quantities of soluble sulphates.

Ammonia Salts.—These were detected by rubbing the powders with water and slaked lime, after ascertaining that ordinary samples of flour gave no reaction for ammonia under the conditions of our tests. No notice was taken of ammonia unless the turmeric paper was rapidly and decidedly colored.

Phosphates.—It was found that even in the presence of tartaric acid these could generally be detected by means of ammonium molybdate in the solution of the powder in very dilute nitric acid. In cases of doubt, the powder was first fused with carbonate of soda and nitrate of potash.

Alumina.—Although it could always be detected in the solution of the powder in very dilute nitric acid, at least, by the aid of acetic acid and phosphate of soda, yet all of the powders were also tested by fusion with carbonate of soda and nitrate of potash, extraction with boiling water, acidifying the filtered solution with hydrochloric acid and precipitating with ammonia-water. The alumina in the precipitate was identified as such, however obtained. During the fusion, abundant evidence of the presence of iron compounds as an impurity in the alum powders was frequently obtained, showing carelessness or ignorance on the part of the makers.

Tartaric Acid and Tartrates.—Free tartaric acid was dissolved out by absolute alcohol and identified. Tartrates were systematically tested for in case of doubt, but, in general, it was deemed sufficient to confirm their presence by shaking the powder with ammonia-water, filtering, adding a crystal of nitrate of silver and heating gently to form the characteristic silver mirror. It was found that phosphates and citrates did not interfere with this test when any considerable quantity of tartrates was also present in the solution, but it was depended on only as confirmation of the presence of tartrates in the cream of tartar powders.

Potash.—This was detected by holding some of the powder on a platinum wire in the Bunsen burner flame and observing the flame coloration through a solution of permanganate of potash so strong as scarcely to transmit diffused daylight. Unless a decided red flame coloration was obtained, potash was certainly absent in any notable quantity.

RESULTS OF ANALYSIS.

The following tables give the results of analysis of our samples, so far as was necessary to classify them and determine their "strength," that is, the percentage of carbonic acid gas. The cubic inches of gas are given from one ounce avoir. of powder, at a temperature of 60° F., and barometer at thirty inches.

I. Cream of Tartar Powders.—In this class are placed all powders giving reactions for tartaric acid and potash, and free from phosphates, alumina, and any considerable quantity of soluble sulphates. Ammonia was sometimes present, whether as sesqui-carbonate or bi-tartrate was not determined. Free tartaric acid was found in one case. Its presence has no effect on the wholesomeness of the powder; nor has the small amount of ammonia in any case found. The writer's experience is that the powders free from ammonia compounds yield just as light biscuits, etc., as the others.

As regards purity of materials, there seems little choice between the higher grades of these powders.

II. Acid Phosphate of Lime Powders.—The first two of these were packed in tightly corked glass bottles, and contained enough starchy material to keep them from deteriorating in these bottles.

The bread preparation consisted of two separate powders, each in a paper package. One was bi-carbonate of soda, the other acid phosphate of lime mixed with starch. The strength was determined on a mixture of the two in the proportions directed on the packages.

The wheat powder was put up in tin boxes, without starch or other filling. One sample was in excellent order, the other much caked.

III. Alum and Phosphate Powders.—This class embraces powders showing ammonia, soluble sulphates, alumina and phosphates, when tested as already described.

A few showed potash reactions, and in some there was evidence of tartaric acid or some other substance reducing silver abundantly from ammoniacal solutions. In such cases, of course, potash alum and bi-tartrate of ammonium may have been present, or the reactions may have been caused by cream of tartar, or by free tartaric acid. The possible combinations are very numerous, and the analysis, however complete, will not always indicate the exact combination. Inasmuch as some of these powders showed considerable alumina in the simple water solution, a more detailed examination of them is recommended, for the reasons already given. The actual presence of acid phosphate of lime, or of any other *acid* phosphate, was not proven, but all contained some phosphate, and have therefore been classed as indicated, although probably in every case they were made with acid phosphate of lime.

As already mentioned, the low grade of several is, perhaps, from deterioration, due to the presence of the acid phosphate in packages not sufficiently air-tight. Acid phosphate will not keep well when mixed with bi-carbonate of soda, except in well corked bottles. Tin cases are not tight enough.

Many of these powders contained sulphate of lime, chemically equivalent to *terra alba.* This was, perhaps, in no case added as an adulterant, but was a part of the acid phosphate of lime used; the latter not having been separated from the sulphate of lime formed in its manufacture. The presence of this sulphate of lime must be regarded as objectionable. None of these powders are as strong as they might be made, and most of them are very deficient in strength. Apart from questions of healthfulness, there can be no economy in buying some of these powders.

IV. Alum Powders.—Here are classed the powders showing the same reactions as the preceding class, but free from phosphates. All appeared to be ammonia alum powders, but reactions for potash and tartaric acid were not wanting among them. Only one of them begins to come up to the strength which a "straight" burnt ammonia alum powder might have.

V. Unclassed Powders.—The composition of these will be indicated under the Special Remarks.

I. CREAM OF TARTAR POWDERS.

Analyst's number.	Brand.	Carbonic acid gas, per cent.	Cubic inches carbonic acid gas, per ounce.	Remarks.
4	The Best	11.60	107.3	
5	Sea Foam	10.86	100.5	Yields a little ammonia and soluble sulphate.
23	Sterling	11.70	108.2	Yields ammonia reactions.
29	Health	6.96	64.4	Final reaction of aqueous solution strongly alkaline. See special remarks.
50	Health	7.25	67.1	
39	None Such	12.64	116.9	
40	Cleveland's	13.27	122.7	Received in June.
43	Cleveland's	13.82	127.8	Received in November.
41	Royal	13.56	125.43	Yields ammonia reactions. Received in May.
42	Royal	13.06	120.8	Yields ammonia reactions. Received in November.
45	Price's "Cream"	11.95	110.5	Received in May. Contains free tartaric acid.
53	Price's "Cream"	12.20	112.9	Received in December.
	Average, 8 brands	11.60	....	Excluding 29 and 50, average is 12.46 per cent. of carbonic acid.

II. ACID PHOSPHATE OF LIME POWDERS.

Analyst's number.	Brand.	Carbonic acid gas, per cent.	Cubic inches carbonic acid gas, per ounce.	Remarks.
46	Horsford's Phosphatic......	14.95	138.3	Received in August. In eight-ounce glass bottle.
54	Horsford's Phosphatic......	14.01	129.6	In retail dealer's stock one year. A little gas escaped on opening the four-ounce bottle.
47	Rumford's Yeast Powder..	13.51	125.0	Received in May. In eight-ounce glass bottle.
48	Rumford's Yeast Powder..	13.89	128.5	Received in August. In eight-ounce glass bottle.
49	Horsford's Bread Preparation	15.39	142.4	Received in August. Bi-carbonate soda and acid phosphate put up in separate papers. The acid phosphate was not quite free from soluble sulphates.
21	Wheat	15.62	144.5	In tin box; in good order.
52	Wheat	5.83	53.9	In tin box; much caked.

NOTE.—Since the rapidity with which a baking powder gives off carbonic acid gas in the cold varies with the ingredients used, it was deemed worth while to test some powders as follows: Forty-five grains (three grammes) of each was mixed, with as little shaking as possible, with one-sixth ounce (five cub. cent.) of water, and the volume of gas evolved in five minutes was measured.

Cleveland's	yielded	49.6	per cent.	of its	carbonic acid.
Royal	"	45.6	"	"	"
Horsford's	"	68.8	"	"	"
A "straight" burnt alum powder	"	6.3	"	"	"

III. ALUM AND PHOSPHATE POWDERS.

Analyst's number.	Brand.	Carbonic acid gas, per cent.	Cubic inches carbonic acid gas, per ounce.	Remarks. (All give ammonia reactions.)
1	Patapsco	8.32	77.0	
2	Washington	8.81	82.5	Received in May.
27	Washington	9.97	92.2	Received in November.
3	Davis' O. K.	8.99	83.2	
7	McDowell's G. & J.	9.70	89.7	
9	Lincoln	9.73	90.0	
10	Kenton	7.01	64.8	Received in October. Another sample, received in May, gave 3.81 per cent.
11	State	6.70	62.0	Received in October.
15	State	8.42	77.9	Received in May.
13	On Top	9.17	84.8	
16	Perfection	5.09	47.1	In paste-board box with tin ends.
19	Silver Star	9.51	88.0	
24	Our Own	10.47	96.8	
35	White Star	10.09	93.3	
28	Somerville	8.39	77.6	
30	Grape	10.02	92.7	
31	Sovereign	8.96	82.9	
32	A. & P. (Atlantic & Pacific)	8.97	83.0	
33	Higgins	6.63	61.3	Received in September.
51	Higgins	11.30	104.5	Received in December.
34	Windsor	8.77	81.1	
37	Brooks & McGeorge	10.16	94.0	
38	Henkel's	10.24	94.7	
	Average, 20 brands	8.97	....	

IV. ALUM POWDERS.

Analyst's number.	Brand.	Carbonic acid gas, per cent.	Cubic inches carbonic acid gas, per ounce.	Remarks. (All show ammonia reactions.)
8	Miles' "Prize"	9.63	89.1	Shows potash reactions and reduces silver abundantly.
20	Four Ace	10.31	95.4	
26	Feather Weight	9.63	89.1	
36	One Spoon	16.77	155.1	Two other samples gave respectively 15.35 and 16.73 per cent.

V. UNCLASSED POWDERS.

Analyst's number.	Brand.	Carbonic acid gas, per cent.	Cubic inches carbonic acid gas, per ounce.	Remarks.
6	Silver Prize	8.14	75.3	Shows potash and ammonia reactions, and reduces silver abundantly.
22	Orange	8.00	74.0	Contains a soluble alumina compound. See special remarks.
18	Our Best	6.15	56.9	Shows ammonia reactions, contains much soluble sulphates, and some free tartaric acid.

SPECIAL REMARKS.

Sample No. 6.—This sample shows strong reactions for ammonia, soluble sulphates, soda and potash. Its aqueous solution, rendered ammoniacal before filtering, reduces silver from a crystal of the nitrate, as a bright coating on the glass. It would have been classed among the cream of tartar powders had it not shown altogether too much soluble sulphates. Shaken with absolute alcohol, it renders this slightly alkaline; boiled with water, the powder gives a decidedly alkaline solution. It contains some alumina.

Sample No. 18.—This gave strong reactions for ammonia, soluble sulphates, soda and potash. Tartaric acid was extracted from it by shaking with absolute alcohol. It may contain some cream of tartar, but has too much soluble sulphates to warrant placing it among the cream of tartar powders.

Sample No. 22.—This powder gave strong reactions for alumina, soluble sulphates and soda. Neither potash nor ammonia was present. The label stated that it contained grape (tartaric?) and orange (citric?) acids, combined "with natron, bicarb. soda and corn starch," and the analysis indicated the presence of tartrates and citrates, as well as much alumina, which was abundantly found in the aqueous solution of the powder even after boiling with the undissolved residue.

Alumina in a soluble form was also extracted in considerable quantity by water alone from bread made with this powder. Apparently, the organic acids kept it in soluble condition. Since neither potash nor ammonia was present, the alumina appears to have been added in the shape of sulphate of alumina, or else of soda alum. After washing away the starchy matter with chloroform and examining the residue under the microscope in polarized light, crystalline fragments of a singly refracting substance were observed in abundance, together with doubly refracting crystalline materials. Although no octahedral crystals could be distinctly made out, yet some fragments resembling octahedra were selected and always found to be singly refracting. The inference is that they were fragments of soda alum, which is as good as any other alum for making baking powders, so far as chemical and physiological effects are concerned. It is more likely to be affected by moisture than " burnt alum."

Sample No. 29.—This powder was very strongly alkaline, containing so great an excess of bi-carbonate (or carbonate) of soda that if the proper amount of cream of tartar had been used the powder would have yielded about 11 per cent. of carbonic acid gas.

CONCLUSIONS.

Our investigations show that while especially the higher grades of cream of tartar and acid phosphate of lime powders are maintained at a quite uniform standard of excellence, the State is flooded, also, with many baking powders of very poor quality—cheap goods, poorly made. Of the thirty-nine brands examined, twenty-five contain alum or its equivalent, in the shape of some soluble alumina compound; eight are cream of tartar powders, with small quantities of other ingredients in several cases; four are acid phosphate of lime powders; two belong properly under none of the above classes.

With one exception, the powders containing alum all fall below the average strength of the cream of tartar powders, and in the majority of cases they fall much below the better grades of the cream of tartar powders.

In the cream of tartar and the acid phosphate of lime powders, no indications of substances likely to be injurious to health, in the quantities used, have been found.

More evidence against the use of alum in baking powders might have been presented, but it would have been of a similar nature to that which has already been given. In the writer's opinion, the presence of alum in baking powders is objectionable, since, under certain conditions, it may exert an injurious effect on the digestion. The effects may not be very marked in the case of any individual consumer, but that they can be induced to a greater or less extent, seems to be well established.

There appears to be ample ground for requiring that the makers of baking powders should publish the ingredients used in their powders, in order that the consumer, who may justly have doubts of the desirability of using certain kinds, may be protected. At present the only guarantee of an undoubtedly wholesome and efficient article appears to be the name of the brand.

Moreover, since it is quite possible to put up the baking powders in such a way as to preserve their strength very thoroughly, and since it is evident that many makers fail in this respect, it would not seem unreasonable to require that baking powders should not be sold unless they will yield a certain percentage of carbonic acid gas. The bad effects of the "heavy" food prepared with some of the baking powders among our samples must certainly be felt by those who use them, and who are yet too ignorant to know where the trouble lies. It is for this class especially that nearly all legislation relating to securing good food and drugs is enacted.

Since it is evident that some of the alum powders are so prepared as to increase the extent of any injurious effect, owing to the mixture of ingredients whose combination cannot be justified on any grounds, it is recommended that a special and more thorough examination of such be made, with a view to preventing their manufacture.

APPENDIX.

1. In bread made from Orange baking powder, page 90, according to directions, there was found, *in a condition readily soluble in tepid water*, alumina equivalent to twenty-six grains of crystallized ammonia alum per two-pound loaf.

2. With reference to Prof. Patrick's experiments on cats, the writer had biscuit made with a "straight" alum baking powder, using *twelve times* the proper amount of the powder. The biscuit had a bitter, nauseating taste, and must have been very indigestible, so that no fair conclusions could be drawn from its use.

DRUGS.

During the year, 415 articles that may be classed under the term drug, have been examined; of these, 182 were equal to the legal standard of purity, and 231 were inferior. The relations between the two were 44.34 per cent. of the whole number pure, and 55.66 per cent. were debased or adulterated.

The following table presents, comprehensively, the condition of the drug trade in this State to-day:

DRUGS EXAMINED.

Article.	Number examined.	Standard.	Not standard.
Borax	6	5	1
Bi-carbonate of sodium	28	19	9
Cream of tartar	95	46	49
Rochelle salts	11	11	0
Tartaric acid	9	9	0
Iodide of potassium	15	4	11
Bromide of potassium	1	0	1
Carbolic acid	9	2	7
Calomel	1	1	0
Sulphur	1	1	0
Milk sugar	1	1	0
Seidlitz powders	28	12	16
Solution of citrate of magnesium	11	11	0
Distilled water	5	0	5
Glycerine	13	9	4
Sulphate of quinia	3	0	3
Alcohol	1	1	0
Ether	4	1	3
Compound spirit of ether	9	1	8
Spirit of nitrous ether	9	0	9
Brandy	12	0	12
Whiskey	15	3	12
Gin	16	3	13
Tincture of opium	42	8	34
Paregoric	3	1	2
Tincture of nux vomica	19	8	11
Powdered opium	4	3	1
Powdered jalap	1	0	1
Powdered rhubarb	2	2	0
Powdered capsicum	1	1	0
Olive oil	40	22	18
Totals	415	164	231

It may be noticed that several articles are placed in this table that are ordinarily used for, or in the preparation of food, but I have been influenced, in this regard, by the terms of the act, which defines these articles as follows:

Section 3 says "That any article shall be deemed to be adulterated, within the meaning of this act—in the case of drugs—first, if when sold under or by a name recognized in the United States Pharmacopœia, it differs from the standard of strength, quality, or purity laid down therein; second, if when sold under or by a name not recognized in the United States Pharmacopœia, but which is found in some other pharmacopœia, or other standard work on *materia medica*, it differs materially from the standard of strength, quality or purity laid down in such work; third, if its strength or purity fall below the professed standard under which it is sold." As the standards of purity for borax, bi-carbonate of sodium, cream of tartar and olive oil are fixed by this section of the law, as they are articles sold under names recognized by the Pharmacopœia, they properly belong in this class.

That there should be so wide a difference between the articles examined and their legal standards—55.66 per cent. falling below the limits—is surprising, and a condition of affairs is revealed that must be radically changed before the public is protected from the evils of a debased drug-supply. As was previously remarked, more accurate knowledge of the articles of trade dealt in by him, is demanded of the druggist than of the grocer. The latter may often be ignorant of the composition of the foods that he has for sale, and cannot always control the purity of his supplies; but the druggist, on the other hand, must, of necessity, be acquainted with the appearance and characteristics of drugs. The State has recognized this, and requires druggists to be registered after having been examined as to their fitness for the position. If a dealer in drugs has doubts concerning their purity, he has but to refer to the legal authorities, the United States Pharmacopœia, or to the National or United States Dispensatories, and apply the simple tests therein given. The condition of the drug market is such that at this time there is no difficulty of obtaining pure drugs at very little advance in cost over debased or inferior articles. Besides these means of insuring purity, I have offered to test, without cost, all drugs sent to me. Taking into consideration all these facts, it must be conceded that druggists failing to supply standard articles, should be prosecuted under the provisions of the law.

I give below the results of the analyses made during the year.

BORAX.

(*Borate of Sodium, U. S. P.*)

Six samples of this substance were analyzed, and but one was found impure. This satisfactory result may be accounted for by the fact that the article is now made carefully on a large scale, and its purity is insured by the manufacturers. The one sample that fell below the standard contained an excessive amount of chloride of sodium. The five pure samples were practically chemically pure.

The specimens examined were purchased in the following places:

Number.	Where Bought.	Results of Analysis.
B 38	Lambertville	Contained an excess of chlorides.
1707	Jersey City	Chemically pure.
1711	" "	" "
1758	Plainfield	" "
1765	"	" "
1781	Newton	" "

BI-CARBONATE OF SODIUM.

Twenty-eight samples were analyzed, of which nineteen were equal to the legal requirements and nine were impure. The United States Pharmacopœia recognizes two qualities—one, the pure bi-carbonate of sodium, used for internal medication; the other, commercial bi-carbonate of sodium. In applying the tests required by the authorities, we were governed by the source whence the sample was obtained. If from a druggist, it was presumed to be that variety used in medicine, and all impurities were sought for; if from a grocer, the sample was expected to conform to the tests prescribed for a commercial article. Little excuse may be offered for the presence of impure sodium bi-carbonate in any store in this State, for the pure article may be easily purchased, and at as low a figure as the debased.

The chief impurities were sulphates and chlorides; in a few instances there was an excess of carbonate.

The following table will show where the samples were obtained, and the results of analysis:

Number.	Marks on Package.	Results of Analysis.
1883	B. T. Babbitt	Traces of carbonate, sulphate and chloride.
A	Rumford Works	" " " " "
2041	Davis, Silvers & Co	" " no sulphate or chloride.
1669	John Dwight & Co	98 per cent. pure.
1677	Davis, Silvers & Co	Traces of carbonate.
1665		Traces of sulphate and chloride.
1689	J. H. Mohlmann	" " " "
1690	Church & Co	Equal to U. S. P. Standard.
1692	Fischer Mills	" " "
1691	Francis Leggat	" " "
1675	James Pyle	Chemically pure.
1686	Thurber, Whyland & Co	" "
1688	S. Wildes' Sons	Excess of chloride.
1687	Gautz, Jones & Co	Slight traces of chloride.
1676	James Olwell & Co	Excess of chloride and carbonate.
1679	No mark	Equal to U. S. P. Standard.
1775	H. O. Ryerson	" " "
1796	G. M. Rea	" " "
1808	S. Dickinson	" " "
1809	W. S. Taylor	" " "
1791	I. O. Park	" " "
1792	" "	" " "
1797	Luce & Linnaberry	" " "
1798	" "	" " "
1727	J. N. Broakaw	" " "
1734	J. V. Case	" " "
1749	G. S. Cook	" " "
1759	J. G. Miller	" " "

CREAM OF TARTAR.

(*Bi-tartrate of Potassium, U. S. P.*)

Ninety-five samples of cream of tartar were analyzed, of which forty-six were standard and forty-nine impure. This result I had expected, for few articles are so commonly debased as this one.

The Pharmacopœia requires that this substance shall be at least 94 per cent. pure, a limit unnecessarily liberal, for cream of tartar containing but one-half of one per cent. of impurity is easily obtained. The standard article, as required by law, must contain no sulphate or chloride, and not more than 6 per cent. of tartrate.

The adulterations detected, in the greater number of debased samples, were clearly intentional, and were not due to lack of care in the methods of manufacture. An excess of tartrate or traces of chloride may well be considered as due to want of skill or lack of care in the maker, but the presence of sulphates, phosphates, alum and flour can be accounted for in one way only, that is, they were added for fraudulent purposes.

Several unique samples were examined. One, purchased at Beverly, contained no cream of tartar, but was a mixture of flour, acid phosphate of lime and sulphate of lime; another sample of the same kind was sold to one of my agents at Cape May. A sample was sold by a dealer at Pemberton that proved to be a mixture of alum, phosphate of lime and 64 per cent. of cream of tartar. Several were obtained in different parts of the State that were adulterated with impure acid phosphate of lime. The following table will show clearly the source of the samples and the results of analyses.

The samples that were equal to the standard were, in at least 90 per cent. of the cases, obtained from druggists, but many from this source were badly debased.

The impure cream of tartar obtained in this State came largely from the southern and western sections, and was sold to dealers by agents and jobbers from Philadelphia. There appears to be a certain relation between the fertilizer trade in that city and the bogus cream of tartar business, the connection probably being due to the trade in impure phosphates.

Two suits were instituted against dealers in the very impure article, these being settled on the payment of costs when the dealer promised to return the adulterated article to the wholesale dealer and to sell only the pure article. Warning notices were sent to all other dealers detected in selling adulterated cream of tartar.

CREAM OF TARTAR.

Number.	Where Purchased.	Results of Analysis.
1708	Jersey City..........	Agrees with standard.
1712	" "	" " "
1715	" "	" " "
1719	" "	" " "
1733	Bound Brook........	94 per cent. pure.
1729	" "	Standard.
1777	Newton	Contains more than 6 per cent. of calcium tartrate and sulphates.
1785	"	Contains more than 6 per cent. of calcium tartrate and sulphates.
1790	Hackettstown........	Standard.
1882	Beverly...............	No trace of cream of tarter. Is phosphate and sulphate of lime.
2003	Cape May............	Is a mixture of acid phosphate of lime, sulphate of lime, and flour.
2008	" "	Mixture of phosphate and sulphate of lime and cream of tartar.
1885	Beverly...............	90 per cent. pure.
1894	Salem..................	98.7 " "
1903	"	98.8 " "
1914	Bordentown	92 " " rest tartrate of calcium.
1919	"	99 " "
1924	"	98 " "
1929	Mount Holly........	97 " "
1985	Pemberton	97 " "
1987	"	64 per cent., rest alum and phosphate of lime.
2035	Jobstown	Contains sulphate and phosphate of lime.
2040	"	97.8 per cent. pure.
2023	Cape May............	98 " "
1938	Mount Holly........	98 " "
1941	" "	98 " "
1950	Bridgeton	98 " "
1959	Bordentown	96.5 " "
1965	"	98 " "
1967	"	98 " "
1974	"	98 " "
2061	Atlantic City.........	99 " "
2048	Quinton	98 " "
B 19	Columbus.............	98 " "
B 26	Lambertville	98 " "
B 33	"	98 " "
B 44	"	98 " "
B 69	Beverly...............	Mixture of cream of tartar and phosphate of lime.
B 71	"	" " " " " "
B 73	"	Acid phosphate and sulphate of lime; no cream of tartar.
B 77	Trenton................	Mixture of cream of tartar and phosphate of lime.
B 79	"	" " " " " "
B 82	"	" " " " " "
B 90	"	Acid phosphate and sulphate of lime; no cream of tartar.
B 93	Cranmer's Hill.....	Acid phosphate and sulphate of lime; no cream of tartar.

CREAM OF TARTAR.

Number.	Where Purchased.	Results of Analysis.
B 95	Cranmer's Hill	Acid phosphate and sulphate of lime; no cream of tartar.
B 102	" "	Acid phosphate and sulphate of lime; no cream of tartar.
B 107	" "	Mixture of cream of tartar and phosphate of lime.
B 117	Phillipsburg	99 per cent. pure.
B 123	"	No cream of tartar; is acid phosphate and sulphate of lime.
B 135	Frenchtown	Cream of tartar and phosphate of lime.
B 138	"	" " " " "
B 142	"	No cream of tartar; is phosphate and sulphate of lime.
B 149	Vineland	Adulterated with sulphate of lime.
B 155	"	" " " "
B 160	"	" " " "
B 173	"	" " " "
B 176	"	" " " "
B 186	Swedesboro	99 per cent. pure,
B 188	"	99 " "
B 195	"	99 " "
B 199	"	99 " "
B 169	Vineland	96 " "
B 204	Phillipsburg	Mixture of cream of tartar, phosphate and sulphate of lime.
B 212	Salem	Adulterated with sulphate of lime.
B 216	"	" " " "
B 223	Vineland	" " " "
B 227	"	" " " "
B 229	"	96 per cent. pure.
B 233	"	Adulterated with sulphate of lime.
B 239	"	" " " "
B 246	Bridgeton	96 per cent. pure.
B 257	"	96 " "
B 268	Burlington	Adulterated with salts of lime.
B 269	"	" " " "
B 170	"	" " " "
B 273	"	" " " "
B 274	"	" " " "
B 275	"	" " " "
B 276	"	" " " "
B 278	"	" " " "
B 280	"	Flour, phosphate and sulphate of lime, and cream of tartar.
B 282	"	Adulterated.
B 271	"	96 per cent. pure.
B 272	"	96 " "
B 277	"	96 " "
B 281	"	96 " "
C 53	Paterson	96 " "
A 296	Trenton	98⅝ " "
A 301	"	Sulphate of lime, starch, etc.
2073	Atlantic City	98 per cent. pure.
2077	" "	98 " "
2080	" "	98 " "
2086	" "	98 " "
B 1	Bridgeton	98 " "

ROCHELLE SALTS.

(*Tartrate of Potassium and Sodium, U. S. P.*)

Eleven samples were analyzed, all of which were pure. The samples were obtained in the following places:

Number.	Where Bought.	Results of Analysis.
1680	New Brunswick.............	Standard.
1891	Beverly.........................	99.5 per cent. pure.
1899	Salem..........	99.5 " "
1908	"	99.5 " "
1936	Mount Holly.................	Pure.
1940	" "	"
1944	" "	"
1953	Bridgeton	"
1960	"	"
1962	"	"
1991	Pemberton	"

TARTARIC ACID.

Nine samples were analyzed, all of which contained 100 per cent. of the acid.

They were purchased as follows:

Number.	Where Bought.	Results of Analysis.
2022	Cape May.....................	Pure.
2029	" "	"
2058	Atlantic City.................	"
2069	" "	"
2078	" "	"
2083	" "	"
2087	" "	"
B 6	Bridgeton	"
B 35	Lambertville	"

IODIDE OF POTASSIUM.

Fifteen samples of iodide of potassium were examined, of which four were equal to the requirements of the United States Pharmacopœia, and eleven were impure according to the tests directed by that authority. The impurities were, excess of alkalinity, presence of undue quantities of iodate and traces of carbonate. As was said in connection with other articles, the large number of impure samples can be accounted for by lack of care by the manufacturers and improper methods of purchase by the dealer. The excess of alkali and the presence of carbonate is due to what seems a desire on the part of the maker to produce a fine-looking crystal, with a translucent, waxy appearance. It is possible to produce, and to purchase, iodide of potassium answering all the tests of the Pharmacopœia.

Number.	Where Bought.	Results of Analysis.
A 220	Trenton	Excess of iodate.
1893	Beverly	Standard.
1784	Newton	Excess of iodate, chloride and bromide.
1964	Bridgeton	" "
1737	Somerville	" "
1930	Mount Holly	" "
1961	Bridgeton	Poor quality. Strong reaction for iodate.
1968	"	Excess of iodate.
1975	"	" "
1984	Pemberton	Poor quality. Excess of iodate.
1992	"	" " " "
1923	Bordentown	Standard.
1928	"	"
1901	Salem	"
1910	"	"

BROMIDE OF POTASSIUM.

One sample, bought at Atlantic City, was examined; was not pure, but contained sulphates and more than 3 per cent. of chloride.

CARBOLIC ACID.

Nine sample were examined, but two of which were of the purity demanded by the Pharmacopœia; the remainder were all deficient in strength and otherwise failed to comply with the standard. The agent making the purchases was instructed to ask for pure carbolic acid, and from the quality of the samples sold him it is to be presumed that he obtained solutions of that article in the place of the crystals, as the request would indicate. One sample was wood creasote.

CALOMEL.

(*Mild Chloride of Mercury, U. S. P.*)

One sample, bought at Lambertville, was pure.

MILK SUGAR.

One sample, bought at Lambertville, was pure.

SULPHUR.

One sample, bought at Lambertville, was pure.

SEIDLITZ POWDERS.

Twenty-eight of these powders were examined, of which twelve were equal to the requirements of the law, and sixteen were deficient. The quality of the ingredients was found to be good, but the deficiency was all due to errors in weighing the substances entering into the composition of these powders. It is the custom with many apothecaries to buy Seidlitz powders in large quantities from manufacturers who make a business of preparing them, and dealers of good reputation may be relied on to sell a correctly-compounded article. Others, on the other hand, competing in price, reduce the weight of the ingredients to such an extent that a profit is insured. This popular aperient is sold also by fancy-goods dealers, and even in dry-goods stores, in our large cities, and they sell the powders as they would other articles, simply for the profit, caring little for the quality or weight of the ingredients.

The dose contained in one of these powders has been accurately ascertained, and any reduction in the quantity is not only fraudulent, but injurious.

The United States Pharmacopœia prescribes that the contents of the white paper shall weigh 35 grains, and the contents of the blue paper 160 grains.

The following table gives the weights of the samples purchased in this State:

Number.	Where Bought.	WEIGHT.	
		White paper, grains.	Blue paper, grains.
1892	Beverly	35	160
1681	New Brunswick	18	137
1709	Jersey City	21	145
1713	" "	38	119
1720	" "	26	156
1900	Salem	31	134
1918	Bordentown	36	153
1927	"	34	170
1909	Salem	Over.	Over.
1937	Mount Holly	33	130
1942	" "	35	160
1955	Bridgeton	30	140
1966	"	28	135
1973	"	35	140
1986	Pemberton	35	140
1993	"	30	160
1728	Bound Brook	35	160
1736	Somerville	35	160
1750	"	36	162
1760	Plainfield	34	160
1776	Newton	35	158
1786	"	37	107
1779	"	34	169
1789	Hackettstown	34	161
1793	"	35	153
1806	Trenton	36	180
1807	"	42	148

SOLUTION OF CITRATE OF MAGNESIUM.

Eleven samples of liquor magnesii citratis were examined, all of which were pure, and according to the requirements of the Pharmacopœia.

These samples were purchased at the following places:

1710, Jersey City; 1735, Bound Brook; 1757 and 1767, Plainfield; 1778, Newton; 1803, 1804, 1805, Trenton; A 2, A 5, A 9, Newark.

DISTILLED WATER.

Five samples of distilled water were analyzed, none of which were pure. The Pharmacopœia directs that this article shall contain no fixed residue, no metals, no salines and no organic matter. The samples examined all contained each of these substances. The agent who made the purchases was directed to ask for the article, and the labels all bore the name, but none was the substance demanded. It was purchased in the following places: 2018, Cape May; 2064, and 2086, Atlantic City; B 2, Bridgeton; B 37, Lambertville.

GLYCERINE.

Thirteen samples were examined, of which nine were standard and four were not.

The samples not equal to the tests were acid and contained acrid matters.

Number.	Where Bought.	Results of Analysis.
1716	Jersey City....................	Acid, acrid.
1718	" "	" "
1761	Plainfield......................	Standard.
1788	Hackettstown	"
2021	Cape May.....................	"
2057	Atlantic City..................	Not pure.
2027	Cape May.....................	Standard.
2074	Atlantic City	"
2081	" "	"
2089	" "	"
B 3	Bridgeton	"
B 20	Columbus.......................	"
B 43	Lambertville	Acid, acrid.

SULPHATE OF QUINIA.

Three samples were analyzed, all of which were obtained at Lambertville, and all of which failed to answer the tests for purity, but contained cinchonidia and cinchonia.

ALCOHOL.

One sample, bought at Lambertville, was pure.

ETHER.

Four samples of ether were examined, but one of which answered to the requirements.

Number.	Where Bought.	Results of Analysis.
1933	Mount Holly	Sp. gr. 0.745, acid.
1943	" "	" 0.730, "
1952	Bridgeton	" 0.719, neutral.
1963	"	" 0.748, acid.

COMPOUND SPIRIT OF ETHER.

Nine samples were examined, of which one was equal to the legal standard and eight were inferior.

The Pharmacopœia states that the compound spirit of ether shall contain 3 per cent. of ethereal oil, or heavy oil of wine. This is an essential ingredient, and one that gives to the compound its therapeutic value. In former times this preparation was much used by physicians, but of late it has fallen into disuse, because the required effects were not obtained. This failure as a medicament, and consequent disuse by the profession, is no doubt due to the fraudulent method of preparation now so common. The chief reason for the omission of the active ingredient is that it costs $25 a pound, hence druggists do not buy the ethereal oil, but sell an article not answering to the Pharmacopœial requirements.

The following table will show where the samples were obtained:

Number.	Where Bought.	Results of Analysis.
1889	Beverly	Contains no oil of wine.
1682	New Brunswick	Deficient in oil of wine.
1780	Newton	Contains no oil of wine.
1732	Bound Brook	Deficient in oil of wine.
1902	Salem	Nearly equal to standard.
1911	"	Trace of oil of wine.
1921	Bordentown	No oil of wine.
1970	Bridgeton	Trace of oil of wine.
A 221	Trenton	" " "

SPIRIT OF NITROUS ETHER.

Nine samples were examined, of which none were equal to the legal requirements. The same remarks may be made with regard to the sweet spirit of nitre, as were made in connection with the previous article; it is extremely difficult to obtain a specimen having the qualities demanded by the Pharmacopœia. In the case of this drug the difficulty is due to the lack of care in its preparation, and also to the faulty methods used to preserve it when made, for it is a very delicate article, and should be kept in small, well-stopped bottles and excluded from the light. It is proper to state, however, that the tests given in the Pharmacopœia are inaccurate, and that sweet spirit of nitre made strictly in accordance with the official formula will not always respond to these tests, even if applied to the spirit immediately after manufacture.

Number.	Where Bought.	Results of Analysis.
1868	Fairton	2.346 per cent. ethyl nitrite.
1890	Beverly	1.437 " " "
A 217	Trenton	1.33 " " "
1683	New Brunswick	0.918 " " "
1755	Plainfield	0. " " "
1898	Salem	1.941 " " "
1907	"	2.528 " " "
1917	Bordentown	2.197 " " "
1934	Mount Holly	2.263 " " "

BRANDY, WHISKY AND GIN.

Forty-three samples of medicinal distilled liquors were examined, of which six answered to the tests given in the Pharmacopœia and Dispensatory, and thirty-seven were inferior. These distilled liquors were all purchased at drug stores, and the dealer was presumed to know that they were intended for medicinal use. The price paid varied from the rate of $4 to $20 a gallon, yet this was not indicative of the quality.

The Pharmacopœia defines brandy to be "an alcoholic liquid obtained by the distillation of fermented grapes, and at least four years old." It shall contain from 36 to 47 per cent., by weight, of alcohol, shall not contain any fusel oil, nor shall the residue obtained by evaporation exceed 0.25 per cent. There should be no evidence that sugar or glycerine has been added, and it should contain a slight amount of tannin derived from the casks. None of the samples answered to these tests, and there was no proof that the article was of the proper age.

The difficulty of obtaining pure brandy of a proper age for medicinal use is very great. This is especially true of the imported article, while that made in California is, as a rule, of inferior quality and not sufficiently aged and bland to be used in cases of illness. The following statement, made in the United States Consular Reports, November, 1887, p. 333, is interesting in this connection:

> "The term 'brandy' seems to be no longer applied to a spirit produced by the fermentation of grapes, but to a complex mixture, the alcohol of which is derived from grain, potatoes, or, worst of all, the refuse of the beet-root refineries. It would seem to be fairly impossible at present to purchase a pure cognac, as each individual proprietor of a vineyard has become a distiller and compounder. He has acquired the art of imitating any special flavor or vintage of brandy that may be called for. Potato spirits and beet alcohols, the most deleterious and obnoxious of all the varieties of spirits, are sent from Germany into France in vast quantities. They are flavored, colored, and branded or labeled to meet the wishes of American connoisseurs. The mere fact of coming out of bond, or 'straight through the custom-house,' is generally accepted here as sufficient evidence that they are pure and genuine. It is rather unfortunate that physicians themselves frequently strengthen this hallucination in favor of imported spirits by giving the most stringent orders to their patients to procure genuine French cognac, even though it may command tenfold the price of an absolutely pure spirit of domestic production. This imperative command becomes a cruel injustice in the case of poor patients. Under the best of circumstances, what is there to be gained by the use of French brandy in preference to pure domestic spirit?"

And, it may be added to this statement, if alcoholic stimulants are to be prescribed by the physician, let him first ascertain the source of the sample and acquaint himself with the quality, origin and ingredients.

The following tables will show the results of analyses. The alcoholic strength varied from 37 to 47 per cent. of alcohol, by weight:

BRANDY.

Number.	Where Bought.	Specific gravity.	Residue, per cent.	Acidity.*	Glycerine.	Caramel.	U. S. P.
1782	Newton	0.932	0.722	5. cc.	Yes.	Yes.	No.
1714	Jersey City	0.939	1.466	Correct.	Yes.	Yes.	No.
1731	Bound Brook	0.937	2.896	"	Yes.	Yes.	No.
1800	Trenton	0.932	0.88	2 cc.	No.	No.	No.
A 11	Newark	0.933	1.181	2. cc.	No.	Yes.	No.
A 30	New Brunswick	0.944	1.554	Correct.	No.	Yes.	No.
A 46	Elizabeth	0.931	0.392	"	No.	Yes.	No.
2016	Cape May	0.934	0.802	"	No.	Yes.	No.
2026	" "	0.935	0.736	"	No.	Yes.	No.
2068	Atlantic City	0.923	0.344	"	No.	Yes.	No.
B 8	Bridgeton	0.937	0.960	"	No.	Yes.	No.
B 24	Columbus	0.935	0.208	4. cc.	No.	Yes.	No.

* Normal solution of soda used.

WHISKY.

Of the fifteen samples of whisky examined, three were equal to the requirements of the Pharmacopœia. That authority defines this spirit as follows: "An alcoholic liquid, obtained by the distillation of fermented grain, generally corn, wheat or rye, and at least two years old." Its alcoholic strength should be between 44 and 50 per cent., by weight. It should contain no fusel oil, not more than 0.25 per cent. of residue, on evaporation, and traces of tannin from the casks. The object sought by this description is to insure a properly-made and aged liquor, and one without irritant or acrid properties.

The same objections to the use of impure or badly-made whisky obtain as were mentioned under the previous head, and physicians should not prescribe for use in cases of sickness a stimulant that fails to meet the Pharmacopœial tests.

The alcoholic strength of the samples examined varied from 34 to 48 per cent. of alcohol, by weight.

WHISKY.

Number.	Where Bought.	Specific gravity.	Residue, per cent.	Acidity.*	Glycerine.	Caramel.	U. S. P.
1773	Newton	0.948	0.817	Correct.	Yes.	Yes.	No.
1762	Plainfield	0.922	0.231	"	No.	No.	Yes.
1717	Jersey City	0.935	0.430	"	Yes.	Yes.	No.
1739	Somerville	0.928	0.123	"	No.	No.	No.
1802	Trenton	0.931	0.600	2. cc.	No.	Yes.	No.
A 1	Hackensack	0.946	1.228	Correct.	Yes.	Yes.	No.
A 6	Newark	0.954	0.542	"	No.	Yes.	No.
A 32	New Brunswick	0.929	0.153	"	No.	No.	Yes.
A 45	Elizabeth	0.936	0.50	2.5 cc.	No.	Yes.	No.
2017	Cape May	0.934	0.69	Correct.	......	......	......
2024	" "	0.936	1.60	"	......	......	......
2062	Atlantic City	0.936	0.47	"	......	......	......
2065	" "	0.936	1.61	"	......	......	......
B 23	Columbus	0.936	0.24	"	......	......	......
B 9	Bridgeton	0.934	0.57	"	......	......	......

* Normal solution of soda used.

No. A 6 had a spicy taste; 1802 contained a residue having a sweet, spicy taste; 1739 contained a residue of a peppery taste, and soluble in water; in 1717 there were floating particles of foreign material; the residue of 1762 had a spicy taste.

GIN.

The Pharmacopœia does not recognize gin as an officinal distilled liquor, but substitutes in its place a compound spirit of juniper. The United States Dispensatory, however, contains a description of this article. Gin was formerly made by the distillation of alcohol containing juniper berries, but very little now in the market is made in that way. It is commonly prepared by flavoring high-wines with essential oils, the oil of juniper, and sometimes turpentine. A large quantity sold in our drug stores has been sweetened by the addition of sugar, and is practically a cordial.

The alcoholic strength of the samples of gin varied from 39 to 47 per cent. of alcohol, by weight.

GIN.

Number.	Where Bought.	Specific gravity.	Residue, per cent.	Acidity.
1747	Somerville	0.928	0.844	1. cc.
1753	Plainfield	0 940	4.655	1.5 cc.
1726	Newark	0.928	0.025	1. cc.
1772	Newton	0.928	1.026	1.05 cc.
1706	Jersey City	0.927	0.008	1. cc.
1799	Trenton	0.935	0.25	0.5 cc.
A 10	Jersey City	0.938	0.25	1. cc.
A 31	New Brunswick	0.930	0.018	0.5 cc.
A 44	Elizabeth	0.936	0.621	1. cc.
A 85	Trenton	0.932	0.045	0.7 cc.
2015	Cape May	0.935	0.242	Correct.
2025	" "	0.924	0.094	"
2066	Atlantic City	0.936	0.342	"
2063	" "	0.936	0.248	"
B 7	Bridgeton	0.936	0.072	"
B 22	Columbus	0.937	0.272	"

The residues in nearly all these samples had a sweet, spicy taste. Nearly all contained essential oils and sugar.

TINCTURE OF OPIUM.

Forty-two samples of this tincture were analyzed. Eight of these were standard, and thirty-four did not contain the quantity of morphia required by the United States Pharmacopœia. That authority directs that tincture of opium shall be made of the powdered drug in the proportion of ten parts to 100 of the finished product, and as standard powdered opium contains not less than 12 per cent. and not more than 16 per cent. of morphia, the tincture must contain at least 1.20 per cent. and not more than 1.60 per cent. of the active ingredient—morphia. Hence, an ounce of laudanum should have in it, on the average, about 6 grains of morphia.

The law requires that articles described in the Pharmacopœia shall in no way differ from the standard of strength, quality or purity laid down therein; hence, any tincture of opium not equal to the standard cannot legally be sold in this State.

The importance of adhering closely to the official formula, and of employing only a crude drug of standard strength in the preparation of this tincture, must be conceded by all, for no more potent medicament is used so commonly as laudanum. The necessity of standard strength must be patent to all, for if a physician is accustomed to prescribe a well-made tincture of opium he obtains constant results, but if the patient is supplied with an inferior article, or one stronger than the standard, disappointing or dangerous results ensue.

The causes of the great discrepancy of so many samples are many and easily ascertained. A weak tincture may be due, when made of opium of minimum strength, to the fact that the menstruum is not thoroughly exhausted; or gum opium has been used, contrary to the formula of the Pharmacopœia; or opium of inferior strength has been used; or other formulæ than the official one have been followed; or the tincture has been made weak intentionally.

A large number of the samples assayed were bought at stores through the rural sections of the State, and all of these were below the standard. Those bought at regular drug stores managed by registered pharmacists were more close to the limit, but too many were below the legal standard. In the latter case no proper excuse can be offered, for a person holding the license of the State Board of Pharmacy is reasonably presumed to be conversant with the requirements of the authorities.

My investigation, in this relation, revealed many important facts concerning the prevalence of the opium habit, and I was surprised to learn the amount of this potent drug, and its tincture, that is sold at country grocery stores; but that the consumption of this article is great, and increasing, was no surprise to me when I ascertained how easily the article could be obtained, notwithstanding the State law that bottles containing the tincture should be labeled and not disposed of to irresponsible persons. I would suggest that some action be taken that will check the sale of opium and its preparations to irresponsible persons, or without an order from a physician.

The methods of analysis outlined by Prof. Cornwall, and published in my last report, have been closely followed in this work. The analyses were made by Prof. H. B. Cornwall, Mr. Shippen Wallace and Mr. August Drescher, of the State Board of Pharmacy.

TINCTURE OF OPIUM.

Number	Where Bought.	Per Cent. of Morphia.
C 13	Somerville	1.535
C 14	"	1.006
94	Paterson	1.18
X 101	"	1.275
1679	New Brunswick	0.78
1730	Bound Brook	0.457
1738	Somerville	0.413
1740	"	0.93
1748	"	0.815
1754	Plainfield	1.17
1766	"	0.488
1783	Newton	0.763
1787	Hackettstown	0.473
1794	"	0.391
1896	Salem	1.27
1905	"	1.17
1925	Bordentown	1.35
1951	Bridgeton	1.16
1971	"	1.21
1976	"	1.20
1869	Fairton	1.03
1887	Beverly	0.93
1915	Bordentown	0.79
1920	"	1.09
1931	Mount Holly	0.98
1958	Bridgeton	1.07
1981	Pemberton	1.06
1988	"	0.87
2038	Jobstown	0.50
2039	"	0.65
2051	Quinton	0.29
2071	Atlantic City	1.18
2079	" "	0.91
2085	" "	1.00
2094	Bridgeton	1.23
B 18	Columbus	0.90
A 214	Trenton	1.22
A 219	"	1.14
A 222	"	0.88
B 25	Lambertville	0.94
B 36	"	1.05
B 41	"	1.02

PAREGORIC.

Three samples of this article were examined, of which one was standard and two were not accurately made.

TINCTURE OF NUX VOMICA.

Nineteen samples were examined, of which eight were standard and eleven did not contain the amount of extract required. The Pharmacopœia requires that this tincture shall contain two per cent. of extract. The following table will show the strength of each sample examined:

Number.	Where Bought.	Per Cent. of Extract.
1888	Beverly	1.495
1678	New Brunswick	2.33
1746	Somerville	2.38
1774	Newton	3.27
1897	Salem	2.45
1906	"	2.97
1916	Bordentown	1.66
1935	Mount Holly	2.10
1954	Bridgeton	2.39
1957	"	2.12
1972	"	1.68
1978	"	2.65
1982	Pemberton	1.86
1989	"	2.35
2072	Atlantic City	1.45
B 21	Columbus	1.75
A 215	Trenton	2.62
A 223	"	2.33
B 40	Lambertville	1.82

POWDERED OPIUM.

Four samples were assayed; three were standard and one was deficient in morphia.

Number.	Where Bought.	Per Cent. of Morphia.
1870	Fairton	12.54
A 47	Trenton	11.19
A 218	"	13.82
A 224	"	13.70

JALAP.

One sample was examined, purchased in New Brunswick, and it contained 7.8 per cent. of resin, which was below the standard.

RHUBARB.

Two samples were examined, both of which were standard.

CAPSICUM.

One sample was examined, and proved to be standard.

OLIVE OIL.

Forty samples were analyzed, of which twenty-two were pure and eighteen were adulterated with, or were wholly, cotton-seed oil.

Number.	Where Bought.	Name on Label.	Analysis.
93	Paterson	Lazell, Dalley & Co.	Contains cotton seed oil.
1886	Beverly	Beverly Pharmacy	Pure.
1895	Salem	J. R. Lippincott & Co.	“
1904	“	Joseph Bassett	“
1663	Jersey City	Dacosine, Bordeaux	Contains cotton-seed oil.
1666	“ “	Huile d'Olive, Nice	“ “ “
1932	Mount Holly	“Sweet Oil”	“ “ “
2000	Cape May	E. Loubon, Nice	“ “ “
1664	Jersey City	S. Rae & Co., Leghorn	Pure.
1939	Mount Holly	None	“
1922	Bordentown	“	“
1926	“	“	“
1969	Bridgeton	“	“
1956	“	“	Trace of cotton-seed oil.
1977	“	“	Pure.
1983	Pemberton	“	“
1990	“	“	“
2001	Cape May	Oliver & Son	“
2020	“ “	None	Contains cotton-seed oil.
2056	Atlantic City	“	“ “ “
2067	“ “	“	Pure.
2076	“ “	“	“
2082	“ “	“	“
291	“ “	“	“
2028	Cape May	“	Trace of cotton-seed oil.
B 5	Bridgeton	“	Pure.
B 34	Lambertville	“	Contains cotton-seed oil.
B 80	Trenton	Eugene du Raix, Bordeaux	Pure.
B 86	“	Alexis Godillot, “	“
B 101	“	Rudolph Chevalier, “	Contains cotton-seed oil.
B 110	“	“ “ “	“ “ “
B 91	“	E. Loubon, Nice	“ “ “
B 98	Cranmer's Hill	“ “	“ “ “
B 74	Beverly	“ “	“ “ “
B 121	Phillipsburg	“ “	“ “ “
B 94	Cranmer's Hill	“ “	“ “ “
B 65	Phillipsburg	“Mohnoel”	Not olive oil.
B 152	Vineland	James Plagniol	Pure.
B 167	“	Alexis Godillot, Jr.	“
B 214	Salem	J. Mottet & Cie.	“

RULES OF THE

STATE BOARD OF HEALTH OF NEW JERSEY

CONCERNING

INSPECTION AND ANALYSIS OF FOOD AND DRUGS.

DUTIES OF INSPECTORS.

1. The Inspector is to buy samples of food or drugs, and to seal each sample in the presence of a witness, if prosecution is intended.

2. The Inspector must affix to each sample a label bearing the number as authorized for that purpose.

3. Under no circumstance is the Inspector to inform the Analyst as to the source of the sample before the analysis shall have been completed.

4. Inspectors are to keep a record of each sample as follows:
    (1) Number of sample.
    (2) Date and time of purchase.
    (3) Name of witness to sealing.
    (4) Name and address of seller.
    (5) Name and address of producer, manufacturer or wholesaler, when known, with marks on original package.
    (6) Name of Analyst and date of sending.
    (7) How sent to Analyst.

5. If the seller desires a portion of the sample, the Inspector is to deliver it under seal. The duplicate sample left with seller should have a label containing the same marks as are affixed to the portion taken by the Inspector.

6. The Inspector is to deliver the sample to the Analyst, taking his receipt for the same, or he may send it by registered mail, express or special messenger.

DUTIES OF THE ANALYSTS.

1. The Chemist or Analyst is to analyze the samples immediately upon receipt thereof.

2. Samples, with the exception of milk and similar perishable articles, are to be divided by the Analyst and a portion sealed up, and a copy of the original label affixed, or the original package preserved, after removing sufficient for analysis, for three months.

3. Should the result of an analysis be disputed in any case in which analysis has been ordered by the State Board of Health, the defendant or person selling the sample in question, or his attorney, may appeal to said Board through its Secretary, and said Secretary shall then require another Chemist to repeat the analysis, using a duplicate portion of the original sample. But when such an appeal shall be made, a sum of money sufficient to cover the expenses of the second analysis shall be deposited with the Secretary of the State Board of Health; which sum shall be paid to the Analyst designated, as required above, to make said second analysis, in case the analysis shall be found to agree with the first in all essential particulars. But in case the sample has been procured by the Dairy Commissioner, or Inspectors appointed by him, any such appeal shall be to the Dairy Commissioner, and the money deposit for the second analysis be made with him, subject to the conditions above stated.

4. In the case of all articles having a standard of purity fixed by any of the laws of the State, the certificate of the Analyst should show the relation of the article in question to that standard.

5. Each Analyst should keep a record-book, in which should be entered notes as follows:

(1) From whom the sample is received.
(2) Date, time and manner of receiving the sample.
(3) Marks on package, sealed or not.
(4) Results of analysis in detail.

6. At the completion of the analysis, a certificate in the form given below shall be forwarded to the Board of Health if the analysis had been ordered through it, or to the Dairy Commissioner if ordered through him.

CERTIFICATE.

To whom it may concern :

I, ..., a Chemist appointed by the State Board of Health of New Jersey, under the provisions of an act entitled "An act to prevent the adulteration of food or drugs," approved March 25th, 1881, do hereby certify that I received from ...., on the .... day of ...., 188..., a sample of ...., sealed as required by the rules of said Board, and bearing the following marks, to wit : ....
....

I carefully mixed said sample and have analyzed the same, and hereby certify and declare the results of my analysis to be as follows : ....
....
.... [*Signature.*]

7. Samples sent to Analysts are to be retained for the space of three months.

EXCEPTIONS REGARDED BY THE BOARD OF HEALTH AS RECOGNIZED BY THE LAW.

Mustard.—Compounds of mustard, with rice flour, starch or flour, may be sold if each package is marked "Compounded Mustard," and if not more than 25 per cent. of such substances are added to the ground mustard. The words "compounded mustard" shall be printed on each package in clear letters, not smaller than great primer.

Coffee.—Mixtures of coffee, with chicory, rye, wheat, pease or other cereals, may be sold if each package is marked "Coffee Mixture," provided that said mixture shall contain at least 25 per cent. of true coffee. The words "coffee mixture" shall be printed on each package in clear letters, not smaller than great primer.

Syrups.—When mixed with glucose, syrups may be sold if the purchaser is informed at the time of the purchase that said syrup is mixed with glucose or grape-sugar.

Condensed Milk.—Condensed milk shall contain at least 8.50 per cent. of fat.

Vinegar.—Vinegar shall contain at least 4.50 per cent. of absolute acetic acid. Vinegar other than pure cider vinegar may be sold if the purchaser is informed at the time of purchase that the article is not cider vinegar.

Milk shall contain the amount of solids required by law.

Canned Goods shall not contain any poisonous metal.

Pickles shall not contain any metal.

Baking Powders.—The market is flooded with large quantities of inferior baking powders, and as these are sold largely to working people, and are used by these people as substitutes for yeast, it is necessary, in order that light bread may be made, that these powders have proper leavening power. This power the cheaper powders do not have, many of them giving off very little carbonic acid gas. These cheap and imperfect baking powders contain alum or phosphate, and are so crudely compounded that a residue is left in the bread or biscuit after baking. The public are warned against these, and in their suppression will be faithfully aided.

The Analysts or Chemists who have been selected under the law as to adulterations of foods or drugs to make examinations when required, are Prof. A. R. Leeds, of Hoboken; Prof. H. B. Cornwall, of Princeton; Shippen Wallace, of Burlington, and Wm. K. Newton, M.D., of Paterson.

Under the Milk law for analyses of milk, the same Chemists, together with August Drescher and H. B. Baldwin, of Newark, were appointed.

In addition, the act as to a State Laboratory, approved April, 1888, provides "that the Chemist or Chemists of the State Agricultural Experiment Station shall analyze all samples of milk, butter or other farm products, or the imitations thereof, that may be sent to said Station by the State Dairy Commission."

EZRA M. HUNT, M.D.,
Secretary.

TRENTON, N. J., February, 1889.

DECISIONS BY THE SUPREME COURT ON THE OLEOMARGARINE LAW.

In 1887, Nathaniel Waterbury was charged with selling oleomargarine which had been stained, colored and mixed with annotto, and with selling oleomargarine made in imitation of natural butter, which had been deceitfully stained, colored and mixed with annotto to give it the semblance and appearance of natural butter, and with selling a substance made in imitation of natural butter, which had been compounded out of animal and vegetable fats not contained in pure milk or cream from pure milk, which substance was deceitfully colored, stained and mixed with a yellow coloring matter in such a manner as to change the normal color thereof and deceptively to give the appearance and semblance of natural butter. The same person was, at the same time, charged with selling oleomargarine which was colored, stained and mixed with annotto. At the same time, one Walter E. Ammon, an agent of Waterbury, was charged with selling oleomargarine which was colored and stained yellow in imitation of natural butter by one of the ingredients thereof, to wit, cotton-seed oil, with which the same was compounded and mixed.

These cases were all tried at the same term of the District Court of Jersey City, and were prepared to test certain important provisions of the law. The State was represented by Mr. William H. Corbin, and the defendants by Messrs. Bedle, Muirhead & McGee. Convictions were had in all the cases, and the defendants immediately took the matter to the Supreme Court on *certiorari*.

In reply to the points made by the attorney of the defendants, the State, through its attorney, Mr. Corbin, answered as follows:

BRIEF OF WILLIAM H. CORBIN, FOR DEFENDANT.

These writs bring up two convictions of Nathaniel Waterbury for selling oleomargarine which had been colored with annotto, and one conviction of Walter E. Ammon for having in possession for the purposes of sale oleomargarine which was colored by cotton-seed oil, in imitation of natural butter, in violation of Section 5 of the act of March 22d, 1886. (Pamph. Laws, 1886, p. 107.)

For convenience, the Waterbury cases have been designated "No. 961" and "No. 985," respectively. These numbers correspond with the numbers placed by the Dairy Commissioner on the samples taken for analysis, and are referred to in the evidence.

In Case No. 961 it was proved that Waterbury, on April 13th, 1887, at Jersey City, sold to George W. McGuire ten pounds of oleomargarine which was stained yellow by annotto. This is not denied. It is expressly admitted.

In Case No. 985 it was proved that Waterbury, on June 1st, 1887, at Jersey City, sold to George W. McGuire ten pounds of oleomargarine which was stained yellow by annotto. This is admitted. But Waterbury proved, in defense, that the oleomargarine was composed partly of colored natural butter and partly of sesame oil, cotton-seed oil, leaf lard, &c., and that the annotto in the oleomargarine came from the natural butter, to which it had been added before the natural butter was used by the compounder of the oleomargarine.

In both cases Waterbury demanded a trial by jury, which was denied, and in both cases offered to prove that oleomargarine "is a wholesome article of food," and "that the two specimens of oleomargarine, so called, involved in these two cases, are wholesome articles of food and well recognized as a food for man." The court overruled the offer.

In the Ammon case the defendant was convicted upon his own confession that "he had in his possession for the purpose of sale a substance which was manufactured or compounded out of beef fat, oil, &c., known and sold in the market as oleomargarine; * * * that said oleomargarine has a yellowish color and has the semblance of natural butter, but says that said color is derived chiefly from the said cotton-seed oil, and also partly from the beef fat, milk and cream, and he says that said cotton-seed oil was not added simply for the purpose of coloring or staining the same, but as one of the substantial ingredients of the compound." The testimony in the other cases, so far as pertinent, was, by agreement, made applicable to this case.

In the first case, No. 961, the facts charged being admitted, the only questions raised are: (1) Are the proceedings regular on their face? (2) Did the District Court err in denying trial by jury? (3) Is the conviction invalid because *scienter* was not alleged or proved? (4) Did the District Court err in rejecting the offer of testimony to show the wholesomeness of oleomargarine? (5) Is the Oleomargarine act of 1886 in conflict with the Constitution of New Jersey? (6) Is the same void because in restraint of trade and commerce? (7) The oleomargarine having been made in Indiana and shipped to New Jersey for sale, is the New Jersey act an unlawful interference with commerce between the States? (8) Is the New Jersey act repugnant to the act of Congress of August 2d, 1886, imposing a tax on oleomargarine?

In Case No. 985, the facts charged are likewise admitted, but this additional question is raised by the reasons set down by the prosecutor: (9) Is it a defense to the complaint to show that the annotto found in the oleomargarine was first put into natural butter, and was introduced into the compound called oleomargarine through the medium of natural butter?

In the Ammon case the facts charged are confessed, but this further question is raised: (10) Is it a defense to a charge of coloring oleomargarine yellow, in semblance of butter, by the use of cotton-seed oil, to show that the cotton-seed oil was used not simply for coloring purposes, but also as a substantial ingredient of the compound?

These ten questions seem to cover all the points indicated by the reasons in the three cases, and will be discussed in their order.

I. Regularity of the proceedings on their face. The case evidence. It is submitted that the complaints, summonses and convictions are in strict conformity with the statute. Pamph. Laws, 1886, p. 107; Pamph. Laws, 1887.

II. There is no trial by jury in cases of this sort. This question is *res adjudicata* in this court. The proceeding is summary, and there is no warrant for trial in any other form. The right of trial by jury does not exist under the act. Carter *v.* Camden District Court, 20 Vr. 600; Hoeberg *v.* Newton, 20 Vr. 617; Shivers *v.* Newton, 16 Vr. 476.

III. Scienter Need Not be Either Charged or Proved.

Guilty knowledge of the character of the substance sold is not essential to a conviction under the act. It is competent for the Legislature to declare an act a crime, whether the act is done knowingly or not.

In Halsted *v.* State, 12 Vr. 589, the Court of Errors (Beasley, C. J.) says: "Nothing in law is more incontestible than that with respect to statutory offenses, the maxim that crime proceeds only from a criminal mind, does not universally apply;" and on page 590: "In many cases an honest mistake in regard to a state of facts will not exculpate when the prohibition of a statute has been violated." The Chief Justice reviews the cases and adds: "It is not necessary to multiply authorities; a crowd of them are collected in the brief of the Attorney-General." (See page 576 for exhaustive discussion of this question by the Attorney-General.) "As there is an undoubted competency in the law-maker to declare an act criminal, irrespective of the knowledge or motive of the doer of such act, there can, of necessity, be no judicial authority having the power to require, in the enforcement of the law, such knowledge or motive to be shown."

Other authorities upon the same point are—

Commonwealth *v.* Farrne, 9 Allen 469.
Commonwealth *v.* Smith, 103 Mass. 445.
Commonwealth *v.* Wentworth, 118 Mass. 441.
Baker *v.* Walling, 1 Cowan 77.
Morris *v.* People, 3 Denio 403.
Rogers *v.* Jones, 1 Wend. 236.
Perry *v.* Edwards, 44 N. Y. 225.

It being clear that the power exists, it only remains to inquire whether the Legislature has by this statute explicitly made the acts complained of offenses, and if so, whether it has limited convictions to such persons as offend with a guilty mind.

It is submitted that the act of 1886 declares the acts complained of offenses in perfectly clear terms, and that without regard to the motives of the offender. The language is explicit and peremptory. (See Section 5.) By the first section it is forbidden to have in possession these counterfeit articles, except in tubs and vessels plainly marked and branded, and, by the seventh section, it is declared that the possession of the same unbranded, by any tradesman, is evidence of intent to sell. The other provisions of the law show a stern purpose in the legislative mind to detect and punish all who offend in handling these substituted articles of food. There is no suggestion of the idea that the defendant may plead ignorance of the nature of what he is selling. No phrase can be found equivalent to those apt words so often used in penal statutes, "any person who shall knowingly commit." On the contrary, the declaration is, "no person shall." The terms are positive and unconditional. Language cannot be plainer. The entire function of the court is to find out the intention of the Legislature and to enforce the law in absolute conformity to such intention." Halsted *v.* State, 12 Vr. 592.

There can be no doubt that the Legislature intended to make the possession or selling of colored oleomargarine an offense. If they intended to require the Dairy Commissioner to prove in every instance guilty knowledge on defendant's part they signally failed to express their meaning. This view of the statute is in harmony with the constructions frequently given by the courts to similar enactments.

Held, no defense to a suit for selling adulterated milk, that the seller believed it to be pure. 9 Allen 489; 37 Hun 441. So, in prosecution for keeping or selling naphtha. 118 Mass. 441. So, in prosecution for selling adulterated or intoxicating liquors, which defendant thought were not intoxicating or adulterated. 15 M. & W. 404; 10 Allen 199; 103 Mass. 444; 10 R. I. 258. So, in selling liquors to minors, it is no defense that the seller honestly believed that the purchaser was of full age. *Vide* many cases collected in 12 Vr. 581.

The language of Judge Benedict in U. S. *v.* Bayaud, 16 Fed. Rep. 384, is peculiarly pertinent to this case:

"Looking at the words employed, as indicating the intent of the law, it is seen that the statute mentions certain ingredients as necessary to constitute the offense, and makes no allusion to knowledge that the casks contained or had contained distilled spirits. It would have been so easy and so natural to have designated such knowledge among the other ingredients, if it had been intended to make such knowledge an ingredient of the offense, that the omission of any expression to that effect goes far of itself, considering the object of the statute, to repel the presumption of such an intention."

There is no hardship in this construction. Oleomargarine made without added color is nearly white, or a pearl color. If a dealer finds it with a yellow, butter-like color, that very fact is evidence that coloring matter has been added. The most casual glance at it will show the presence of the added color. So that a dealer who sells oleomargarine colored yellow in imitation of butter, of necessity does so with a guilty mind.

IV. The Wholesomeness or Unwholesomeness of Oleomargarine was Not at Issue, and Evidence Thereon was Properly Rejected.

The court properly excluded the testimony offered to show that the colored oleomargarine mentioned in the complaint was a wholesome article of food.

By the eighteenth section of the act it is declared that the objects of the act are "to prevent deception in the sale of oleomargarine, butterine, or any imitation of any dairy product, and to preserve the public health."

It is a matter of common knowledge that oleomargarine is always and everywhere a counterfeit article. It is a cheap article made to take the place of butter.

During the siege of Paris, in 1871, one Meige, a Frenchman, who was living in the suffering city, discovered that by the use of beef tallow he could produce an article that could be used as a substitute for butter.

This he called oleomargarine. It was white, but was not unpalatable, and was very cheap. After the siege was raised it speedily occurred to thrifty persons on both sides of the Atlantic that if this new product could be made to *look* like butter and *taste* like butter it could be *sold* for butter, to the great profit of the compounders of it. Accordingly, a little cream or milk was added to the mixture to help the taste, and enough annotto to produce a rich yellow, butter-like color, and a dash of salt to give it flavor. These precautions properly observed, the product cannot be distinguished by the ordinary observer from actual butter. This is oleomargarine at its best estate. It is no longer made in this way. Not content with the profits to be made by substituting tallow for butter, the makers of this interesting "food product" have improved upon M. Meige's invention by introducing those cheapest of all fats, cotton-seed oil, sesame oil, and last and chiefly, hog lard.

A new commercial area has thus been opened to the "Great American Hog." He now enters into competition in a business heretofore monopolized by the gentle, cud-chewing cow, to wit, the making of butter. It is interesting, as a matter of history, to note that the swine has been introduced to this new and lucrative field of industry not, as might be supposed, by the cunning thrift of a Connecticut Yankee, but by the pious hand of a Connecticut Jew, one of those chosen ones to whom the Lord said by the mouth of Moses: "And the swine, though he divide the hoof and be cloven-footed, yet he cheweth not the cud; he is unclean to you. Of their flesh shall ye not eat, and their carcass shall ye not touch; they are unclean to you." Leviticus XI., 5, 6.

The fact is that oleomargarine, from being the makeshift of a starving people shut up in a beleaguered city, has become a notorious article of spurious food, and it was as such that it first came under legislative notice.

The motive for legislative action was the patent fact that a new, cheap counterfeit of a common article of food had been just put upon the market and was being habitually palmed off for a genuine article.

There are unknown as well as known dangers to health in such a counterfeit.

When it is understood that by these shrewd inventions *any fat* can be made to appear like butter and be made to pass for it, the dangers become apparent. First, tallow was used, next hog lard, then cottonseed oil and a variety of other fats. By proper manipulation any kind of animal, vegetable, or even mineral oil may be introduced into a substance that shall appear to be butter, and which shall deceive all except experts.

It matters not whether the fat be taken from an animal crushed to death in transit, or starved to death, or killed of disease, so long as it has fat, it will make oleomargarine; for it is to be remembered that the very theory of the oleomargarine-makers is that all fats are so nearly identical in their nature that they may be made to fulfill the uses of the fat of cream.

It needs no argument to show that dangers to the health of the people lie in such frauds.

It may be freely admitted, for the sake of argument, that oleomargarine properly made from beef fat is harmless; it may be admitted that the oleomargarine involved in these cases was wholesome. That is of no importance.

The fact being that a counterfeit article of food is in the market, the Legislature is the sole judge of the means necessary and expedient to protect the public health against it.

This is a part of the police power of the State. Its exercise involves the exercise of legislative discretion as to what is expedient for "the protection of the lives, health and property of the citizens, and to the preservation of good order and public morals. The Legislature cannot, by any contract, divest itself of the power to provide for these objects. They belong emphatically to that class of objects which demand the application of the maxim, *salus populi suprema lex*, and they are to be attained and provided for by such appropriate means as the legislative discretion may advise."

Beer Company *v.* Mass., 97 U. S. 33.
See, also, Slaughter-House Cases, 83 U. S. 62.

Under it in England from the earliest times and in this country from its earliest colonization it has been customary "to regulate ferries, common carriers, hackmen, bakers, millers, wharfingers, innkeepers, &c. * * * And we think it has never yet been successfully contended that such legislation came within any of the constitutional prohibitions against interference with private property."

Munn *v.* Illinois, 94 U. S. 125.

Under this police power the sale of intoxicating liquors and beer and cider, pure or impure, is restricted and prohibited.

The killing or possession of game is regulated under it.

Phelps *v.* Racy, 60 N. Y. 10.

Slaughter-houses are regulated.

Board of Health *v.* Heister, 37 N. Y. 663.
Cronin *v.* People, 82 N. Y. 373.
Slaughter-House Cases, 16 Wall. 36.

Laundries have been regulated and controlled.

Barbier *v.* Connally, 113 U. S. 27.
Soon Hing *v.* Crowley, 113 U. S. 703.

So with warehouses.

Munn *v.* Illinois, 4 Otto 113.

The price of gas and water has been fixed.

115 U. S. 679.
110 U. S. 347.

The intermarriage of white and colored persons has been forbidden.
State *v.* Jackson, 80 Miss. 177.
Pace *v.* Alabama, 106 U. S. 585.

The observance of the Sabbath has been compelled.
Neuendorff *v.* Duryea, 69 N. Y. 563.

The laws of New Jersey furnish copious illustrations of the exercise of this power.

The act of 1685 regulated the branding of beef and pork barrels.
Leam. & Spic. 508.

Other illustrations are the act regulating the weight of bread (L. & S. 545); the act against unreasonable tolls (L. & S. 547); the act regulating the raking of oysters (Nevill 88); the acts regulating weights and measures (Nevill 142); the act of 1774 regulating the packing of beef and pork (Allison 450).

All these were passed before the New Jersey Constitution of 1776, and multitudes of similar acts since.

The offering for sale of adulterated food is a common-law offense, and a subject of legislative correction from time immemorial.

Blackstone, in Book IV. of the Commentaries, has a chapter devoted to the title "Of offenses against the public health and the public peace or economy," in which the exercise of the police power in the prohibition of adulteration in foods is amply illustrated.

V. The Oleomargarine Act of 1886 is not in Conflict with the New Jersey Constitution.

We have already seen that the act is within the well-recognized scope of legislative action in the exercise of the police power in conserving the public health. There is another well-grounded basis for this act, not less in consonance with the history and tendency of legislation.

It is valid and legitimate as a measure for *the suppression of cheating in trade.* The very title of the act expresses this purpose as clearly as it expresses the other: "An act *to prevent deception in the sale* of oleomargarine, butterine, or any imitation of dairy products, and to preserve the public health." So, in the eighteenth section, it is declared that the purpose of the act is "to prevent deception in the sale of oleomargarine," and, in the language of the late Mr. Justice Parker, "it was enacted to prevent cheating in trade in the sale of articles made to imitate butter and cheese."

Carter *v.* Camden District Court, 20 Vr. 601.

The first offense aimed at by this act, viz., cheating in trade, is a common-law offense no less clearly than the other offense already considered, to wit, the offering for sale of adulterated food.

See Black. Com., Book IV., Chapter 12, entitled "Of Offenses Against Public Trade." And it was from the earliest times the subject of repressive legislation. Blackstone calls the acts which were passed "that prodigious multitude of statutes which are made to restrain and punish deceits in particular trades."

4 Bl. Com., ch. 12, p. 157.

Numerous examples of these statutes may be found in "Burn's Justice," published in London in 1754, twenty-two years before the first Constitution of New Jersey. A peculiarly appropriate one is the act "concerning the packing, weight and goodness of butter and cheese," which appears to be a revision and consolidation of the acts of 14 Chas. II. and 4 Wm., which were superseded by the acts of 36 and 38 Geo. III.

By these acts, the kind of package, the size, weight and shape, are prescribed; that it must be branded by the cooper, and by the dairyman with his full name in at least three places, under penalty of £5.

Sections 4 and 5 read as though they might have been directed to the suppression of the oleomargarine fraud:

"4. No butter which is old and corrupt shall be mixed or packed up into any such vessel with that which is new and sound, nor shall any whey butter be packed or mixed with that which is made of cream; but every such vessel shall be of one sort and goodness throughout; and no butter shall be salted with any great salt; but with fine small salt, and not intermixed with more than is needful for its preservation, on pain of forfeiting five pounds for every offense.

"5. If any change, alteration, fraud or deceit shall be used or practiced, either in the vessel wherein butter is packed for sale, as aforesaid, *or in the butter* itself, whether in quantity, *quality*, weight or otherwise, or in such brands or marks, * * * every person concerned therein shall forfeit thirty pounds."

1 Burn's Justice 528–9.

These provisions are nearly identical with some of the provisions of our act of 1886.

Section 2 of our act reads thus: "No person shall offer or expose for sale * * * * any mixture or compound of natural butter or cheese with * * * * any substance not the product of pure milk or cream from pure milk, except," &c.

Illustrations might be multiplied indefinitely of similar regulations long before our Constitution. A few will suffice.

Adulteration of or false weights in bread, 1 Burn's Jus. 384.
False weights in coal, 1 Id. 631.
Using logwood in dyeing woolen goods blue, 5 Id. 655.
Undue stretching of cloth, 5 Id. 656.
Fraud in packing or making candles, 2 Id. 214.
Coloring and adulterating tea, coffee and chocolate, 2 Id. 140.

Instances of this sort of legislation in New Jersey in colonial days have been given above, and instances in great numbers can be found under the Constitution of 1776, and under the present Constitution, all in the same line of policy, reaching down to the present day.

Such are the Milk laws, the Oyster laws, the Cranberry laws, the Herring laws and the Beer laws.

The act, therefore, is within the legitimate scope of legislative power, and presents nothing novel either in theory or procedure, or in the terms in which it is framed. No cruel or unusual punishments are provided.

Unless some express provision of the Constitution can be shown, inconsistent with the terms of this act, it is impossible to see wherein it is unconstitutional.

VI. The Act is not Void as an Undue Restraint of Trade.

Every police regulation for the suppression of cheating in trade, and this act is such (20 Vr. 600), does undoubtedly restrain trade to a greater or less degree. The liquor traffic is hampered by the license system, but this court has said that the point that such regulation "restrains trade and creates a monopoly has been too frequently exploded to be seriously discussed."

Sparks *v.* Stokes, 11 Vr. 492.

Laws and ordinances relating to the "comfort, health, convenience, good order, and general welfare of the inhabitants are comprehensively styled police laws, and it is well ruled that laws and regulations of this character, though they may disturb the enjoyment of individual rights, are not unconstitutional, although no provision is made for compensation for such disturbance."

Hall *v.* Thompson, 48 Sup. Ct. N. Y. 481.

"The Legislature may pass many laws the effect of which may be to impair or even destroy the right of property. Private interest must yield to public advantage. All legislative powers not restrained by express or implied provisions of the Constitution, may be exercised."

Phelps *v.* Lacy, 60 N. Y. 14.
Reutholf *v.* Reilly, 74 N. Y. 521.

It should be noted that the act in question does not forbid free, honest dealing in oleomargarine. It only forbids its fraudulent sale for butter, and to that end prescribes, first, that it shall be kept in branded packages; and second, that it shall not be colored.

VII. The Oleomargarine Act is not an Unlawful Interference with Commerce Between the States.

It is asserted that this act is an attempted interference by the State of New Jersey with the power of Congress to regulate commerce between the States under Section 8 of Article I. of the Federal Constitution.

The oleomargarine in question was made in Indiana and shipped thence to Jersey City, consigned to Waterbury, a citizen of New York, having a place of business in Jersey City.

So far as the transmission of oleomargarine is concerned, it is clear that the New Jersey statute does not interfere with it.

It is only when the article is brought here for sale that the regulations of our law are brought into use, and the question is, does New Jersey, by requiring tubs to be branded and in refusing to permit colored oleomargarine to be sold here, attempt to usurp the powers of Congress to regulate inter-state commerce?

Certainly not. The State may pass laws which incidentally do regulate commerce. Property within a State, wheresoever made, must be subject to the State laws.

Phelps *v.* Lacy, 60 N. Y. 15.
Munn *v.* Illinois, 4 Otto 135.
State *v.* Addington, 77 Missouri 110.

Under a tonnage tax laid on oyster fishing boats in Maurice river cove, a Philadelphia boat was condemned. *Held*, that the regulation enforcing the tax was not an interference with inter-state commerce, the tax being laid on all boats whether belonging in the State or out of it.

Johnson *v.* Loper, 17 Vr. 321.

Prohibitions and regulations applicable to all classes of citizens are not violations of the Federal Constitution.

Munn *v.* Illinois, 4 Otto 125.
Slaughter-House Cases, 16 Wall. 37.
Bartinger *v.* Iowa, 18 Wall. 133.

So, it has been held that a federal license to sell liquor is of no force against the State law prohibiting the sale.

McGuire *v.* Commonwealth, 3 Wall. 387.

VIII. The New Jersey Act is not repugnant to, but in harmony with, the Act of Congress of August 2d, 1886, Imposing a Tax on Oleomargarine.

By Section 3 of said act of Congress of August 2d, 1886, being "An act defining butter," &c., "special taxes" are imposed on dealers in oleomargarine, and Sections 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241 and 3243 of the Revised Statutes of the United States (title, Internal Revenue) are, "so far as applicable, made to extend to and include and apply to the special taxes imposed by this section, and to the persons upon whom they are imposed."

These sections relate to the payment of special taxes, the procurement of stamps, &c. The last-mentioned section, 3243, is as follows:

"3243. The payment of any tax imposed by the internal revenue laws for carrying on any trade or business, shall not be held to exempt any person from any penalty or punishment provided by the laws of any State for carrying on the same within such State, or in any manner to authorize the commencement or continuance of such trade or business contrary to the laws of such State, or in places prohibited by municipal law; nor shall the payment of any such tax be held to prohibit any State from placing a duty or tax on the same trade or business, for State or other purposes."

It will be observed that the act of Congress "defining butter," &c., makes no provision for issuing licenses for the sale of oleomargarine. It merely lays a "special tax" on dealers and provides for its enforcement. It expressly recognizes the power of the States to further regulate, tax or prohibit the traffic, and it does so in the same terms (R. S., Sec. 3243) in which the same power of the States is recognized with respect to whisky, beer and tobacco.

This provision of law recognizing the State authority has been construed by the Supreme Court and is too clear for argument. Even in face of a federal license it was held that the State might regulate and prohibit.

McGuire *v.* Commonwealth, 3 Wallace 387.

The Court said: "In view of this provision (a provision in same terms as Sec. 3243), it is in vain to attempt to give force or effect to the license against the State law; and hence the authority derived from it, upon which the defendant relied for his defense in the court below, fails."

In the License Tax Cases, 5 Wallace 462, Chief Justice Chase comments on Section 3243 (act of July 13th, 1886, 14 Stat. 98), and says that Congress, in framing that act, "has carefully guarded against any misconstruction of the legislative intention by substituting throughout the term 'special tax' for the word 'license.' This judicious legislation has removed all future possibility of the error that there was obtained under the internal revenue laws, 'authority for carrying on the licensed business independently of State regulation and control.' "

IX. It is no Defense to a Charge of Deceitfully Coloring Oleomargarine with Annotto in Semblance of Butter to show that the Annotto was first put into Butter and the Butter then used as an Ingredient of the Oleomargarine.

The prosecutor claims that the fact that the annotto came from the natural butter relieves him from the charge of having sold oleomargarine colored with annotto. There is no pretense that the oleomargarine was not as effectively and visibly colored as it would have been by the direct application of the annotto, but it is argued that because the act defines oleomargarine to be certain fats compounded either with or without natural butter as an ingredient (Sec. 6) the prosecutor has a right to make up his oleomargarine *with* a mixture of natural butter. And inasmuch as the statute defines natural butter to be cream butter, either with or without coloring matter, he has a right to select such as is colored, and so get into his compound by indirection that which he could not introduce directly (Sec. 6). Such a construction of the act can only be made by reading the sixth section alone, while giving no force to the fifth section, which declares that no oleomargarine shall be sold "that is colored, stained or mixed with annotto or any other coloring matter or substance."

These sections should be construed together. There is no inconsistency in them. Both may stand; the language of Section 5 is noteworthy—"colored, stained or *mixed* with annotto." These words thus disjoined have a meaning, they are not mere idle reiteration; colored means the direct adding of color; stained is a stronger word—the substance shall not have even a stain or tinge of the color. Mixed has another meaning; the substance shall not be intermingled with the color. The same word is used in Section 6 in defining oleomargarine "any compound or mixture of natural butter * * * * with any of these substances," &c.

Putting the two sections together we may fairly read them thus: "You may make oleomargarine by mixing in some butter, but you shall not mix any annotto into oleomargarine." But if there were any doubt of the meaning of these sections it was cleared up by the declaratory amendment of April 21st, 1887: "Nothing in said act shall be so construed as to permit the sale or the offering or exposing for sale * * * * of any oleomargarine * * * * that is colored, stained or mixed with annotto or any other coloring matter or substance."

X. It is no Defense to a Charge of Coloring Oleomargarine Yellow in Semblance of Butter, by using Cotton-Seed Oil, to show that the Cotton-Seed Oil was Used not Alone for Coloring, but also as a Substantial Ingredient of the Compound.

It appears by the evidence that the makers of oleomargarine are actively experimenting with various dark-colored vegetable oils for the purpose of obtaining a yellow color without using annotto or sage or other ingredient which is solely a coloring matter—the theory of the prosecution being that if a coloring matter be added which is something more than a color, which not only gives color but adds weight to the product, that the law will be successfully evaded.

It appears that cotton-seed oil of a very dark color can be had, and by its judicious use, or by the use of some other oil he knows of, Mr. Nathan I. Nathan says, "I can gain the result." Gain what result? The staining yellow of his oleomargarine without annotto.

By the plea of defendant Ammon, and by the reasons, it appears that the prosecutor relies on this ingenious subterfuge to escape from the operation of the act.

The prosecutor says the color was chiefly derived from the cotton-seed oil (which is true), but he says that he added the cotton-seed oil not simply for the purpose of coloring or staining the same, but as one of the *substantial* ingredients of the compound.

Here is the purpose to color the compound frankly avowed, and the coloring agent is named, but because it answered not only the fraudulent end of coloring the compound, but also another purpose, viz., of adding to the weight, he asks to be held guiltless. Nathan swears that with 300 pounds of cotton-seed oil, in a churning of 2,300 to 2,400 pounds, he "gained the result." Ammon says he put in "about twenty per cent."

It is submitted that this defense is unsound. The act forbids not only the adding of "annotto," and of "other coloring matter," strictly so called, but goes further and forbids the coloring by any "*substance*."

Substance means something substantial and not a mere trace or tinge or cloud of a thing. The amendment of 1887 repeats the same words and declares that no oleomargarine shall be sold colored with any coloring matter or substance. It is to be remembered that at the time of the passage of the act in question, oleomargarine uncolored by coloring matter was a white, almost colorless thing, and is so now when made by any usual or ordinary methods, and that the color produced by Nathan is the result of prolonged experimenting with "substances" to thwart the very law now under consideration.

Following are the decisions of the Supreme Court in these cases:

NEW JERSEY SUPREME COURT.

JUNE TERM, 1888.

State, Nathaniel Waterbury, Pros.,
v.
William K. Newton, State Dairy Commissioner.
Certiorari.

1. The form of conviction prescribed by the supplement of the Oleomargarine act, which went into effect May 1st, 1887 (P. L., 1887, p. 192), may be used in prosecutions instituted after that date for offenses previously committed.

2. Under Section 5 of the Oleomargarine act, approved March 22d, 1886 (P. L., 1886, p. 107), it is not essential to the guilt of a person selling oleomargarine colored with annotto that he should know that the oleomargarine was so colored.

3. The legislative design in enacting this section was to secure to dairymen and to the public generally a fuller and fairer enjoyment of their property, by excluding from the market a commodity prepared with the view of deceiving those purchasing it, and of obtaining thereby an improper advantage over rival commodities offered for sale; hence, it is immaterial that the prohibited commodity is a wholesome food, since it would be equally wholesome if prepared without the deceptive ingredient.

4. The Legislature may forbid the sale of counterfeits.

5. Laws passed by the individual States, under their general authority over internal concerns, may incidentally affect foreign and inter-state commerce without conflicting with the Constitution of the United States, provided they do not discriminate against such commerce and are not inconsistent with the acts of Congress.

6. The act of March 22d, 1886 (P. L., 1886, p. 107), rendering penal the sale of oleomargarine colored with annotto, is valid as applied to a sale made in this State by the agent of the manufacturer in Indiana, although the package sold here was that which had been sent by the manufacturer from Indiana to this State for sale.

Argued February Term, 1888, before Justices Van Syckel, Knapp and Dixon.

Mr. J. D. Bedle, for plaintiff in *certiorari.*
Mr. W. H. Corbin, for defendant.

The opinion of the court was delivered by Dixon, J.

The plaintiff in *certiorari* having, on April 13th, 1887, in Jersey City, sold to George W. McGuire a package of oleomargarine colored with annotto, was convicted, before the District Court of said city, of thereby violating Section 5 of the "Act to prevent deception in the sale of oleomargarine, butterine, or any imitation of dairy products, and to preserve the public health," approved March 22d, 1886 (P. L., 1886, p. 107). This conviction is now before us for review.

One objection made by the plaintiff is that the record of conviction is not in the form generally required for summary proceedings of this nature. The form adopted is that prescribed in the amendatory act, which went into effect May 1st, 1887 (P. L. 1887, p. 192). The sale was made before May 1st, but the prosecution was instituted after that date. The Legislature has the right to regulate the mode of procedure in prosecutions for antecedent offenses, so long as the substantial protections with which the existing laws surround the accused are not impaired. Cooley's Const. Lim. 272. The mere form in which the technical record should be made up is not one of these substantial protections, and if the Legislature of 1887 has indicated a purpose to make their form applicable to previous sales, that purpose should be enforced. We think the language of the supplement expresses such a design.

Another objection is that it was neither averred nor proved below that the plaintiff in *certiorari* knew that the oleomargarine was colored with annotto, and without such knowledge he could not, it is urged, be guilty of a penal act.

In Halstead *v.* State, 12 Vroom 552, the Court of Errors laid down the principle that, in regard to statutory offenses, the defendant's knowledge of all the physical facts which go to constitute the offense is not essential to guilt, unless made so by a proper construction of the statute itself. The briefs in that case refer to many decisions illustrating the principle. On recurring to the statute now under review it is plain that there are no words in the enactment showing a purpose to make knowledge a constituent of the penal act. The prohibition is in clear and simple terms against the sale of oleomargarine colored with annotto. Unless, therefore, there be discoverable, in what may be deemed the general design of the Legislature, an intention to limit this language to cases where the seller is shown to be cognizant of the character of the article sold, the terms of the statute should be effectuated. This general design, as declared both in the title and in the body of the act, is to prevent deception in the sale of oleomargarine, and, if we have regard to the public sentiment out of which the law sprung, it was, we think, not only to avoid, for the sake of purchasers, the danger of their buying oleomargarine under the belief that it was butter, but also thereby to secure to the manufacturers of butter those advantages which fair and open competition would afford. The object was not to punish acts intrinsically wrong, but to prevent acts which in their results operated unjustly upon others. This object would be thwarted if sales could be made with impunity by those ignorant of the ingredients of the article sold. This interpretation of the law does not savor of undue severity. No doubt it may impose some hardship upon some innocent venders. But the means which dealers in these products generally have of informing themselves as to the substances of which they are compounded, are so ample that but few will suffer save through design or negligence, while no practicable degree of caution would protect purchasers; and it is manifest that the Legislature has thought proper to incur the slight risk of injustice to the few in order to escape the greater risk of injustice to the many.

The plaintiff further objects that as oleomargarine, though colored with annotto, is a wholesome article of food, the Legislature has no power to prohibit its sale.

If the sole basis for this statute were the protection of the public health, this objection would be pertinent and might require us to consider the delicate questions whether and how far the judiciary can pass upon the adaptability of the means which the Legislature has proposed for the accomplishment of its legitimate ends. But, as already intimated, this provision is not aimed at the protection of the public health. Its object is to secure to dairymen and to the public at large a fuller and fairer enjoyment of their property by excluding from the market a commodity prepared with a view to deceive those purchasing it. It is not pretended that annotto has any other function in the manufacture of oleomargarine than to make it a counterfeit of butter, which is more generally esteemed and commands a higher price. That the Legislature may repress such counterfeits does not admit, I think, of substantial question. Laws of like character have of late years been frequently assailed before the courts, but always without success. A reference to many of them will be found in

Powell *v.* Commonwealth, 114 Pa. St. 265; S. C., 8 Sup. Ct. Rep. 992, and State *v.* Arensberg, 105 N. Y. 123. The validity of the present act was recognized in this court in Carter *v.* Camden District Court, 20 Vroom 600.

Another objection suggested by counsel is that the application of the statute to the present case is a violation of the provision of the Federal Constitution which empowers Congress to regulate commerce among the several States.

The plaintiff in *certiorari* was an agent of the manufacturer in Indiana, and sold the oleomargarine in the package in which it had been sent to him by his principal for sale. The package contained ten pounds only, and there is nothing in the testimony to indicate that it was sold here for the purpose of being transported out of the State or otherwise than it would have been sold directly to a consumer. Whether the State can prevent such a sale seems not yet entirely settled under the decisions of the Supreme Court of the United States.

As far back as Brown *v.* Maryland, 12 Wheat. 419, that court decided that a State law requiring an importer to take a license before he should be permitted to sell imported goods in the original package, was in conflict with the constitutional clause prohibiting States from levying duties on imports, and also with that giving Congress the power of regulating commerce with foreign nations and among the several States. And as recently as last March, in Bowman *v.* Chic. & N. W. R'way Co., 8 Sup. Ct. Rep. 689, Mr. Justice Matthews, delivering the judgment of the court, that a statute of Iowa forbidding common carriers to bring intoxicating liquors into the State, except on consignment to persons licensed to sell the same, was contrary to the commerce clause of the Constitution, expressed his purpose to refrain from rendering any opinion on that point, whether the right of transportation from one State to another includes, by necessary implication, the right of the importer to sell in unbroken packages at the place where the transit terminates. Between these cases there are many decisions and still more numerous judicial discussions upon this large and complex theme of commercial regulation, and it is difficult to gather from them all what rules are to control the subject. But so far as I have been able to analyze them I think these principles are deducible:

First. The power to pass laws which directly regulate foreign or inter-state commerce is vested in Congress exclusively, except that in particular instances where it would be impracticable to enforce rules uniform throughout the country, the individual States may pass such laws, provided they be not inconsistent with the acts of Congress. Of this exceptional character have been considered laws relating to pilots, 12 How. 299; port regulations, 21 How. 184; ferries, 1 Black 603, 107 U. S. 365; bridges over navigable waters, 3 Wall. 713, 113 U. S. 205; liens upon vessels, 21 Wall. 558; the improvement of harbors, bays and rivers, 102 U. S. 691; wharfage, 105 U. S. 559, 121 U. S. 444, and quarantine, 118 U. S. 455.

Second. Laws passed by the individual States in pursuance of their general authority over internal concerns may incidentally affect foreign and inter-state commerce, provided they do not discriminate against such commerce and are not inconsistent with the acts of Congress. On this principle State laws were maintained with respect to their incidental effect upon commerce, in The License Cases, 5 How. 504; Woodruff *v.* Parham, 8 Wall. 123; Hinson *v.* Lott, 8 Wall. 148; Reading R. R. Co. *v.* Pennsylvania (tax on gross receipts), 15 Wall. 284; Osborne *v.* Mobile, 16 Wall. 479; Railroad Co. *v.* Fuller, 17 Wall. 560; Sherlock *v.* Alling, 93 U. S. 99; Munn *v.* Illinois, 94 U. S. 113; Chicago R. R. Co. *v.* Iowa, 94 U. S. 155, *et seq.;* Machine Co. *v.* Gage, 100 U. S. 676, and Smith *v.* Alabama, 124 U. S. 465. But in Welton *v.* Missouri, 91 U. S. 275; Railroad Co. *v.* Huson, 95 U. S. 465; Cook *v.* Pennsylvania, 97 U. S. 566; Guy *v.* Baltimore, 100 U. S. 434; Webber *v.* Virginia, 103 U. S. 344, and Walling *v.* Michigan, 116 U. S. 446, State regulations were adjudged inoperative against foreign or inter-state commerce, on account of their unfavorable discrimination.

The difficulty of determining whether a State law amounts to an attempt to regulate foreign or inter-state commerce directly, and is therefore invalid, under the principle first stated, or only incidentally affects such commerce, and so may be sustained upon the second principle, will be readily surmised, and the fluctuations of the Supreme Court itself in endeavoring to observe the demarcation may, I think, be perceived on comparing Reading R. R. Co. *v.* Pennsylvania (tax on gross receipts), 15 Wall. 284, with Philadelphia S. S. Co. *v.* Pennsylvania, 122 U. S. 326; Munn *v.* Illinois, 94 U. S. 113; and the following cases, with Wabash R. R. Co. *v.* Illinois, 118 U. S. 557, and Machine Co. *v.* Gage, 100 U. S. 676, with Robbins *v.* Shelby Taxing District, 120 U. S. 489. Such a comparison will justify the remark of Mr. Justice Miller, in Fargo *v.* Michigan, 121 U. S. 230, 240: "With reference to the utterances of this court, until within a very short time past, as to what constitutes commerce among the several States, and also as to what enactments by the State Legislatures are in violation of the constitutional provision on that subject, it may be admitted that the court has not always employed the same language, and that all the judges of the court who have written opinions for it may not have meant precisely the same thing."

Adopting these principles as *criteria,* the present statute seems valid with regard to the transaction now under consideration. Bearing in mind what has been said as to the purport of this law, and noting the declarations of the Supreme Court of the United States in reference to the scope of the police power of the States, the enactment appears to come within this department of legislative authority. "The police power," says Mr. Justice Field, in The Slaughter-House Cases, 16 Wall. 87, "undoubtedly extends to all regulations affecting the health, good order, morals, peace and safety of society." So, Mr. Justice Bradley, in Beer Co. *v.* Massachusetts, 97 U. S. 33: "There seems to be no doubt that the police power extends to the protection of the lives, health and property of the citizens, and to the preservation of good order and the public morals;" and Mr. Justice Harlan, in Guy *v.* Baltimore, 100 U. S. 443: "In the exercise of its police powers a State may exclude from its territory, or prohibit the sale therein of any articles which, in its judgment fairly exercised, are prejudicial to the health or which would endanger the lives or property of its people." A statute forbidding the sale of an article manufactured with the view of deceiving purchasers and in a manner likely to accomplish that result, is within the power thus described.

The application of this statutory prohibition to sales of oleomargarine brought from other States, and not intended for further transportation, produces only an indirect and incidental effect upon inter-state commerce. It may be conceded that, according to the views expressed in Brown *v.* Maryland, 12 Wheat. 419, goods imported for the purpose of sale continue to be the subjects of foreign or inter-state commerce until the imported package is broken up or sold by the importer, and until they become thus incorporated with the mass of property in the State, traffic in them is free from all legislative regulations except such as Congress may prescribe, whose silence would only evince a purpose to have the traffic untrammeled. But later judicial opinions depart somewhat from these views. Thus, Chief Justice Taney, in The License Cases, 5 How. 566, said: "Although the gin sold (being in the original package) was an import from another State, and Congress have clearly the power to regulate such importations under the grant of power to regulate commerce among the several States, yet as Congress has made no regulations on the subject, the traffic in the article may be lawfully regulated by the State as soon as it is landed in its territory, and a tax imposed upon it, or a license required, or the sale altogether prohibited, according to the policy which the State may suppose to be its interest or duty to pursue." So, in Hinson *v.* Lott, 8 Wall. 148, Mr. Justice Miller, speaking of a State law which imposed a tax of fifty cents a gallon on liquors introduced into the State for sale (a like tax being levied upon liquors manufactured in the State), said: "As the effect of the act institutes no legislation which discriminates against the products of sister States, but merely subjects them to the same rate of taxation which similar articles pay that are manufactured within the State, we do not see in it an attempt to regulate commerce, but an appropriate and legitimate exercise of the taxing power of the States." So, in Brown *v.* Houston, 114 U. S. 622, coal in New Orleans, transported thither from Pennsylvania by its owners, who resided in Pittsburgh, was decided to be subject to taxation in common with other property, under the laws of Louisiana, Mr. Justice Bradley saying: "The coal had arrived at its destination and was put up for sale—it was a commodity in the market of New Orleans—it had become a part of the general mass of property in the State." Likewise, in Robbins *v.* Shelby Taxing District, 120 U. S. 497, Mr. Justice Bradley said: "When goods are sent from one State to another for sale, or in consequence of a sale, they become part of its general property and amenable to the laws, provided that no discrimination be made against them *as* goods from another State." Having thus held that goods brought into one State from another become subject to the general jurisdiction of the former State as soon as they are deposited at their final destination, the court, in Coe *v.* Errol, 116 U. S. 517, decided that goods intended for transportation to another State did not pass beyond the general jurisdiction of the State in which they were, and into the exclusive jurisdiction of Congress, as articles of inter-state commerce, until they were shipped or entered with a common carrier for transportation to another State, or were started upon such transportation in a continuous route or journey.

In conformity with these later cases it seems proper to conclude that the package of oleomargarine with which we are now dealing, became, on its delivery to the consignee in Jersey City, subject to our laws relating generally to all articles of that nature in the State, unless those laws are opposed to the legislation of Congress. The only federal law with reference to the selling of oleomargarine is that passed August 2d, 1886 (24 U. S. Stat. at Large, p. 209), regulating the manufacture, &c., and imposing a special tax on those dealing in it. This law incorporates with itself Section 3243 of the Revised Statutes, which expressly repels the inference that the payment of such a tax will legalize the traffic, and implies that the prohibition of such traffic by State legislation is permissible. McGuire *v.* Commonwealth, 3 Wall. 387; License Tax Cases, 5 Wall. 462; Pervean *v.* Commonwealth, 5 Wall. 475.

Our opinion is that the State law is constitutional. None of the objections presented by the plaintiff can prevail, and his conviction should be affirmed.

NEW JERSEY SUPREME COURT.

JUNE TERM, 1888.

State, Nathaniel Waterbury, Pros.,
v.
The State Dairy Commissioner, Wm. K. Newton. } *Certiorari.*

If oleomargarine derive any color or stain from "annotto or any other coloring matter or substance," mixed in at any stage of the manufacture, whether of the several ingredients or of the final product, then the sale of that oleomargarine is forbidden by the Oleomargarine act (P. L., 1886, p. 107).

Argued February Term, 1888, before Justices Van Syckel, Knapp and Dixon.

Mr. J. D. Bedle, for plaintiff in *certiorari.*
Mr. W. H. Corbin, for defendant.

The opinion of the court was delivered by Dixon, J.

The sole question presented in this case, and not covered by the decision just rendered in Waterbury *v.* Newton, arises from the fact that the only annotto which gave color to the oleomargarine sold by the plaintiff in *certiorari*, was that contained in the butter which formed an ingredient of the oleomargarine.

The plaintiff contends that, under Section 6 of the Oleomargarine act (P. L., 1886, p. 107), "natural butter" may contain coloring matter, and oleomargarine may be made by compounding such "natural butter" with any animal or vegetable or mineral oil or fat, and that if, in such compounding, no additional coloring matter be used the resulting product is oleomargarine simply, and not "oleomargarine * * * that is stained, colored or mixed with annotto or any other coloring matter or substance," the sale of which is prohibited by Section 5 of the act.

We think this is not the true reading of these sections. We understand the law to mean that what the act calls "natural butter" will not cease to be such, within the purview of the law, by having coloring matter in it, but that, if oleomargarine derives any color or stain from annotto or any other coloring matter or substance, mixed in at any stage of the manufacture, whether of the several ingredients or of the final product, then the sale of that oleomargarine is forbidden. In order that the sale of oleomargarine may be lawful, no annotto or other coloring matter or substance must have entered into its composition.

The conviction brought up should be affirmed.

NEW JERSEY SUPREME COURT.

JUNE TERM, 1888.

State, Walter E. Ammon, Pros.,
v.
William K. Newton, State Dairy Commissioner. } *Certiorari.*

In Section 5 of the Oleomargarine act (P. L., 1886, p. 107), the clause "annotto or any other coloring matter or substance," includes only those substances which, in the manufacture of oleomargarine, &c., are used, like annotto, solely or chiefly to color the product, and does not extend to the materials which are employed chiefly to make up the substance of the compound, and which impart color only as a necessary incident of their use.

Argued February Term, 1888, before Justices Van Syckel, Knapp and Dixon.

Mr. J. D. Bedle, for plaintiff in *certiorari*.
Mr. W. H. Corbin, for defendant.

The opinion of the court was delivered by Dixon, J.

The plaintiff in *certiorari* was charged with having in his possession for the purposes of sale, on May 18th, 1887, in Jersey City, "oleomargarine which was colored and stained yellow in imitation of natural butter by one of the ingredients thereof, to wit, cotton-seed oil, with which the same was mixed and compounded." To this he pleaded in effect that cotton-seed oil is a nutritious vegetable oil, that it formed about one-fifth of the product called oleomargarine, and was used in the manufacture, not simply for the purpose of coloring or staining the product, but as one of its substantial ingredients. On this plea he was convicted.

On *certiorari* to review this conviction, the question arising is whether, if oleomargarine derive a color resembling that of butter from the substantial ingredients of which it is composed, it is unlawful to have it in possession for the purpose of sale, by reason of the statute which interdicts such possession of "oleomargarine that is colored, stained or mixed with annotto or any other coloring matter or substance." (P. L., 1886, p. 107.) In other words, the question is, whether the substantial ingredients of the compound may belong to that class which in the act is described as consisting of "annotto and any other coloring matter or substance."

This question should be answered, I think, by the application of two well-settled legal rules; one, that the coupling of words together shows that they are to be understood in the same sense, according to the maxim *noscitur a sociis;* the other, that penal laws are to be construed strictly.

Under these rules, the clause "annotto or any other coloring matter or substance," extends only to coloring substances which resemble annotto in the use to which it is put in manufacturing the products covered by the statute. The office of annotto in these processes is solely to color the product. By "other coloring matter," therefore, are intended other substances of similar quality; substances used merely, or at least chiefly, for the same purpose. The language cannot with propriety be interpreted so as to include materials employed chiefly to make up the substance of the compound, and which impart some color only as a necessary incident of their use. To construe the statute so broadly would render it practically prohibitive of the sale of all oleomargarine, for of course the compound must derive color from its ingredients, and such a prohibition has manifestly not been declared.

The supplement of 1887 (P. L., 1887, p. 192) makes no change in this respect.

We think that the plaintiff's plea did not show his guilt, and that his conviction should be quashed.

REGULATIONS CONCERNING

THE ANALYSIS OF FOODS AND DRUGS,

ISSUED BY THE

UNITED STATES TREASURY DEPARTMENT.

In determining whether the sample examined indicates that an offense, under the law, has been committed, the analyst and the Commissioner of Internal Revenue will be governed by certain standards. An offense shall be deemed to be committed within the meaning of the act, as to the manufacture or sale of an article, (*a*) In the case of drugs: (1) If, when sold under or by a name recognized in the United States Pharmacopœia, it differs from the standard of strength, quality or purity laid down therein; (2) If, when sold under or by a name not recognized in the United States Pharmacopœia, but which is found in some other pharmacopœia, or other standard work on *materia medica,* it differs materially from the standard of strength, quality or purity laid down in such work; (3) If its strength or purity falls below the professed standard under which it is sold. (*b*) In the case of foods, when it does not conform to the following standards:

BUTTER AND CHEESE.

Butter and cheese shall be made exclusively from milk or cream, or both, and with or without common salt. For butters, the percentage of water shall not be more than 12, and salt not more than 5, and fat not less than 83. The minimum specific gravity, "actual density," shall be 0.910 at 40° C. (104° F.) for the filtered fat, and the results obtained by Reichert's method shall not be less than 12.0 c.c. for 2.5 grams of fat.

COCOA AND CHOCOLATE.

Cocoa is prepared from the roasted seed of the tree Theobroma cacao, either partly ground, "cocoa-nibs," or in powder. It shall contain not less than 45 per cent. of cocoa butter or fat; nitrogen, not less than 2 per cent.; ash, not less than 3 per cent.; theobromine, not less than 1.5 per cent., and starch, not more than 15 per cent.

Chocolate being a mixture consisting of cocoa paste and sugar, flavored with vanilla, cinnamon, cloves, &c., and mixed with flour or starch, must be sold as such and properly labeled.

COFFEE.

Coffee shall be composed entirely of the seed of the Caffea Arabica and not adulterated with chicory, caramel, other grains, as corn, wheat, rye; roots and seeds, as dandelion, mangel-wurzel, turnips, beans, pease, &c. Gummy matter not less than 21 per cent.; fat not less than 14.5 per cent.; caffeine not less than 0.6 per cent.; ash not less than 4 per cent., of which 75 per cent. at least shall be soluble.

HONEY.

Honey shall consist of the saccharine substance collected by the bee (Apis mellifica) from the nectaries of flowers, and deposited by them in the cells of the comb. It shall not contain any added starch-sugar (glucose), cane-sugar, or inverted sugar.

LARD.

Lard shall be made exclusively from the rendered fat of the hog. It shall not contain any cotton-seed oil, beef stearin, or other foreign fats, and the percentage of moisture shall not exceed 0.5. Its specific gravity, "actual density," at 40° C. (104° F.) shall not exceed 0.904.

MALT LIQUORS.

Malt liquors shall consist of the fermented alcoholic infusion of malted barley or malt substitutes with water, flavored with hops or other wholesome bitters. They shall not contain antiseptics, alkaline bi-carbonates, salt, except that derived from the water used in brewing, or unwholesome bitters.

"As a rule, Bavarian draft and lager beers contain from 1.5 to 2 parts of extract for each part of alcohol. If glucose or other non-nitrogenous bodies have been used in appreciable quantity as substitutes for malt, the percentage of nitrogen in the extract will fall below 0.65. The acidity of a beer should not be greater than 3 c.c. of normal alkali solution to 100 c.c. beer. Acidity of less than 1.2 c.c. of normal alkali solution to 100 c.c. beer indicates previous neutralization. If the acids are composed principally of lactic acid a larger quantity may be present. The ash of normal beer should not exceed 0.3 grams to 100 grams beer. The amount of glycerine in pure beer is not greater than 0.25 grams to 100 grams beer."—(Methods of judging the purity of beer adopted by the Union of Bavarian Chemists.)

MILK.

Whole (pure) milk, the minimum specific gravity, "actual density," shall be 1.030 at 60° F., and the milk shall contain not less than 13.0 parts in 100 of solids, as follows:

Fat	3.5
Solids, not fat	9.5
Water, not more than	87.0

The removal of cream, the addition of water, foreign fats, or coloring matter will be considered adulterations.

MUSTARD.

Mustard shall be made exclusively from the seeds of Sinapis nigra and Sinapis alba. It shall not contain any wheaten flour or other foreign meals, turmeric or other coloring matter.

Moisture not more than 6 per cent.; ash not more than 5 per cent.; fixed oils not less than 33 per cent.

OLIVE OIL.

Olive oil shall be made exclusively from the olive berry, Olea Europea. It shall not contain any cotton-seed, sesame, or other foreign vegetable oil. Its specific gravity at 15.5° C. (60° F.), "actual density," shall not be more than 0.917 nor less than 0.914.

OYSTERS.

The addition of water to opened oysters sold by measure is considered an adulteration.

PEPPER.

Black pepper shall be the dried unripe berry of Piper nigrum. White pepper being the same fruit deprived of its outer skin by maceration in water and friction. It shall not contain foreign meals, capsicum or other dilutents or substitutes.

Cayenne shall consist of the ground berry and pods of Capsicum annuum. It shall not contain foreign meals or artificial coloring matters.

TEA.

Tea shall be composed entirely of the leaf of the tea-plant, not adulterated with spurious leaves or with exhausted leaves, nor contain so great an admixture of chemicals or other deleterious substances as to make it unfit for use. Leaves to which the term "exhausted" is applied means, and includes, any tea which has been deprived of its proper quality, strength or virtue by steeping, infusion, decoction or other means. (See act of Congress "To prevent the importation of adulterated and spurious teas," approved March 2d, 1883.)

Total ash shall not be less than 4.5 per cent. nor more than 7 per cent., 50 per cent. of which shall be soluble in water. Ash insoluble in water, not more than 3 per cent. Extract not less than 30 per cent. Insoluble leaf not more than 60 per cent.

VINEGAR.

If cider vinegar, it shall be the legitimate product of pure apple juice, known as apple cider or vinegar, made exclusively of apple cider or vinegar, and into which no foreign substances, ingredients, drugs or acids have been introduced, and shall contain not less than 1.5 per cent. of total solids.

All vinegar shall have an acidity equivalent to the presence of not less than 5 per cent., by weight, of absolute acetic acid.

WHEATEN FLOUR AND BREAD.

Flour shall be composed entirely of ground wheat, free from bran, perfectly white or having a faint tinge of yellow. Must not show red, gray or black specks, nor possess a disagreeable odor. Must contain no foreign meals, as rye, corn, barley, pease, beans, rice, linseed, buckwheat and potato-starch; no alum to disguise the presence of damaged flour in mixtures or to improve the appearance of an inferior grade, &c.

Ash not more than 0.6 per cent. Albuminoids not less than 10.5 per cent. Moisture not more than 12 per cent.

Bread.—Moisture not more than 31 per cent. Ash not more than 1.5 per cent. Albuminoids not less than 6.25 per cent.

The addition of alum, sulphate of copper, borax, sulphate of zinc and foreign meals will be considered adulteration.

WINE.

Wine is the liquid product which results from the alcoholic fermentation of the juice of fresh grapes, with such additions only as are essential to the stability or keeping of the liquid.

The addition of water, distilled spirits, glycerine, sugar, coloring matter and antiseptics, shall be considered adulterations.

Imitations and artificial wines, and demi-wines, as hereinafter defined, shall also be considered as adulterations.

" Artificial wines are those made without grape juice, with a mixture to imitate wine, such as water, brandy, glycerine, sugar, tartaric acid, œnanthic ether, &c.

" Demi-wines are those resulting from the addition to the must or natural wine, of water and other substances intended to produce the taste of wine in such diluted and attenuated liquids (sugar, glycerine, brandy), or made in the same manner with grape marc already used in the preparation of must."—(Austrian Decree of September 16th, 1880.)

" Wines which are made wholly from pure grape juice very seldom contain a less quantity of extract than 1.5 grams in 100 c.c. wine. If wines poorer in extract occur they should be condemned, unless it can be proven that natural wines of the same district and vintage occur with a similar low content of extract.

" After subtracting the 'fixed acids' the remaining extract (*extractrest*) in pure wines, according to previous experience, amounts to at least 1.1 grams in 100 c.c., and, after subtracting the 'free acids,' at least 1 gram. Wines which show less *extractrest* are to be condemned in case it cannot be shown that natural wines of the same district and vintage contain as small an *extractrest*.

" A wine which contains appreciably more ash than 10 per cent. of its extract content must contain, correspondingly, more extract than would otherwise be accepted as a minimum limit. In natural wines the relation of ash to extract approaches very closely one to ten parts by weight. Still, a considerable deviation from this relation does not entirely justify the conclusion that the wine is adulterated.

"The amount of free tartaric acid in pure wines, according to previous experience, does not exceed one-sixth of the entire 'fixed acids.'

"The relation between alcohol and glycerine can vary in pure wines between 100 parts by weight of alcohol to 7 parts by weight of glycerine; and 100 parts by weight of alcohol to 14 parts by weight of glycerine. In case of wines showing a different glycerine relation, an addition of alcohol or glycerine can be inferred.

"As sometimes during its handling in cellars small quantities of alcohol (at most 1 per cent. by volume) may find their way into wine, this fact must be borne in mind in judging of its purity.

"These proportions are not always applicable to sweet wines.

"Wines that contain less than 0.14 gram of mineral matter in 100 c.c. are to be condemned, if it cannot be shown that natural wines of the same kind and the same vintage, which have been subjected to like treatment, have an equally small content of mineral matter.

"Wines which contain more than 0.05 gram of salt in 100 c.c. are to be condemned.

"Wines that contain more than 0.092 gram sulphuric acid (SO_3) corresponding to 0.20 gram potassic sulphate ($K_2 SO_4$) in 100 c.c., are to be designated as wines containing too much sulphuric acid, either from the use of gypsum or in some other way."—(Rules for judging of the purity of wine adopted by the Berlin Commission in 1884, and published August 12th, 1884, by the Prussian Minister of Commerce and Trade.)

"Addition of alcohol is to be assumed if the ratio of alcohol to glycerine is greater than 10 to 1 by weight.

"Addition of water and alcohol is recognized by the diminution in the quantity of inorganic matter, especially magnesia, phosphoric acid, and usually potash. Addition of water alone is recognized in the same way.

"Scheelization, *i. e.* addition of glycerine, is assumed if the ratio of glycerine to alcohol exceeds 1 to 6 by weight.

"The presence of cane-sugar is ascertained by a determination of sugar (by Soxhlet or Knapp's method) before and after inversion."—(Methods of judging purity of wine adopted by the Union of Bavarian Chemists.)

(c) Where standards of strength, quality or purity are not fixed by these regulations, they will be fixed at the time the analysis is made.

The following substances are known to be injurious to health when present in foods: Salts of antimony, arsenic, barium, except the sulphate; bismuth, cadmium, chromium, cobalt, copper, iron, the chloride and sulphate, though most iron salts are harmless; lead, magnesium, nickel, zinc, and some of the potassium and sodium salts; oxalic acid, picric acid, cocculus indicus (Indian berry, Levant nut), picrotoxine, gamboge, aniline, aloes, eosine, fuchsine, and its immediate derivatives; coloring matters containing nitrous vapors, as naphthol yellow, Victoria yellow; coloring matters prepared with diazo compounds.

The following substances are known to produce more or less toxic effects, and whose presence in food is therefore harmful, and whose use is forbidden, under severe penalties, in most foreign countries having laws on the subject: Salicylic acid and its salts, boracic acid and borax, glycerine, alum, beta-napthol.

The following is a list of harmless coloring matters:

Black.—Chinese black.

Blues.—Berlin blue, indigo, litmus, Prussian blue, saffron blue, ultra-marine.

Brown.—Caramel.

Greens.—Chlorophyl, as spinach juice, mixtures of yellow colors with blue. A mixture of Prussian blue, Berlin blue, and Persian berries, gives a green rivaling in brilliancy Schweinfurt's green.

Reds.—Annotto, Brazil lac, carmine, carmine lac, cochineal, orseil, the juice of beets and red berries, such as cherries and currants, &c.

Yellows.—Avignon berries, curcuma, fustel, marigold, Persian berries, quercitron, safflower, saffron, turmeric.

Chalk and the ochers.

TABLE OF CONTENTS.

PAGE.

Report of the Commissioner 3
Articles of Food Examined 7
Oleomargarine 9
Milk 11
Lard 15
American Canned Goods 19
Imported Canned Goods 25
Coffee 27
Tea 29
Ground Spices 31
Extracted Honey 39
Maple Syrup 41
Molasses 43
Vinegar 45
Pickles 47
Food at the State Camp 49
Lead in Carbonated Beverages 51
Notes on the Baking Powders Sold in the State 53
Report on the Composition and Comparative Healthfulness of the Baking Powders Sold in this State. By Prof. Henry B. Cornwall 63
Drugs Examined 93
Borax 95
Bi-carbonate of Sodium 95
Cream of Tartar 96
Rochelle Salts 100
Tartaric Acid 100
Iodide of Potassium 101
Bromide of Potassium 101
Carbolic Acid 101
Calomel 102

Milk Sugar........ 102
Sulphur........ 102
Seidlitz Powders........ 102
Solution of Citrate of Magnesium........ 103
Distilled Water........ 104
Glycerine........ 104
Sulphate of Quinia........ 104
Alcohol........ 104
Ether........ 105
Compound Spirit of Ether........ 105
Spirit of Nitrous Ether........ 106
Distilled Liquors........ 106
Brandy........ 108
Whisky........ 108
Gin........ 109
Tincture of Opium........ 110
Paregoric........ 112
Tincture of Nux Vomica........ 113
Powdered Opium........ 113
Jalap........ 113
Rhubarb........ 114
Capsicum........ 114
Olive Oil........ 114
Rules of State Board of Health Concerning Inspection and Analysis of Foods and Drugs........ 115
Decisions of Supreme Court on the Oleomargarine Law........ 119
Brief of William H. Corbin in Waterbury and Ammon Cases... 119
Case of Waterbury against Newton. Supreme Court Opinion.... 135
Case of Ammon against Newton. Supreme Court Opinion....... 143
Regulations of United States Treasury Department Concerning Foods and Drugs........ 147

REPORT

OF THE

Dairy Commissioner

OF THE

State of New Jersey

For the Year 1894.

TRENTON, N. J.:
MacCrellish & Quigley, Printers, Opposite the Post Office.
1895.

Report of the Dairy Commissioner

To the Senate and General Assembly:

I herewith submit my annual report for the year of 1894, embracing work done under the laws governing the sale and adulteration of milk and the law preventing the deception in the sale of oleomargarine and imitation of dairy products, with the supplements thereto.

There has been collected in fines under the above acts ten hundred and fifty dollars.

Two thousand and sixty-six samples in all have been collected and analyzed, the analytical work having been done by Prof. Leeds and Mr. Wallace.

The report also contains the report of Mr. Shippen Wallace, the Chemist of the Department; also the report of Prof. Albert R. Leeds on Dairying and its Relation to the Inspection of Milk; also a paper by Dr Wm. H. Katzenbach on the Epidemic of Typhoid Fever at Bay Head during the past summer.

GEO. W. McGUIRE,
Dairy Commissioner.

OLEOMARGARINE.

We have endeavored to restrict the sale of this article within the limits of the law. I stated in my last annual report that many persons received oleomargarine from other States in original packages in violation of our State law. This was also the case in the States of New York and Pennsylvania, both of which have prohibitory laws against the manufacture or sale of the article, and yet persons having United States Government license sold the article in open market, claiming protection under the inter-State commerce law. They were also sustained in their action by a number of the lower courts.

The United States Supreme Court have already decided, however, that butter substitutes designed to look like butter are deceptive and that States may exclude them if they think it wise, or regulate without encroaching on the right of Congress to regulate inter-State commerce.

The following are the principal portions of the opinion rendered by the United States Supreme Court affirming the constitutionality of the Massachusetts law in restraint of sales of oleomargarine. The opinion was read by Justice Harlan:

Plumley, the plaintiff in error, was convicted in the Municipal Court of Boston upon the charge of having sold in that city on the 6th day of October, 1891, in violation of the law of Massachusetts, a certain article, product, and compound, known as oleomargarine, made partly of fats, oils and oleaginous substances, and compounds thereof, not produced from unadulterated milk or cream, but manufactured in imitation of yellow butter produced from pure unadulterated milk and cream.

The prosecution was based upon a statute of that Commonwealth approved March 10th, 1891, and entitled "An act to prevent deception in the manufacture and sale of imitation butter." By that statute it is provided as follows:

"Section 1. No person, by himself or his agents or servants, shall render or manufacture, sell, offer for sale, expose for sale, or have in his possession with intent to sell, any article, product, or compound made wholly or partly out of any fat, oil, or oleaginous substance or compound thereof, not produced from unadulterated milk or cream from the same, which shall be in imitation of yellow butter produced from pure unadulterated milk or cream of the same: *Provided*, That nothing in this act shall be construed to prohibit the manufacture or sale of oleomargarine in a separate and distinct form, and in such manner as will advise the consumer of its real character, free from coloration or ingredient that causes it to look like butter."

Plumley sued out a writ of habeas corpus from the Supreme Judicial Court of Massachusetts upon the ground that he was restrained of his liberty in violation of the Constitution and laws of the United States.

The case was heard before one of the Justices of that court and was reported to the full court on the petition and on the following facts and offer of proof:

"The proceedings are as alleged in the petition. The article sold by the petitioner was the article the sale of which is forbidden by Chapter 58 of the Acts of 1891. Oleomargarine has naturally a light-yellowish color, but the article sold by the petitioner was artificially colored in imitation of yellow butter.

"The allegations concerning the quality or wholesome character of the article sold are not admitted. The petitioner offers to prove the allegations of the petition in respect to the character and qualities of the article, and the Commonwealth objects to such proofs as immaterial, and the petitioner is to have the benefit of his offer if found material.

"It is admitted that the article sold was sent by the manufacturers thereof, in the State of Illinois, to the petitioner, their agent in Massachusetts, and was sold by him in the original package, and that in respect to the article sold the importers and the petitioners had complied with all the requirements of the Act of Congress regulating the sale of oleomargarine, and it was marked and distinguished by all the marks, words, and stamps required of oleomargarine by the laws of this Commonwealth."

The vital question in this case is, whether, as contended by the petitioner, the statute under examination, in its application to sales of oleomargarine brought into Massachusetts from other States, is in conflict with the clause of the Constitution of the United States investing Congress with power to regulate commerce among the several States.

It will be observed that the statute of Massachusetts which is alleged to be repugnant to the commerce clause of the Constitution, does not prohibit the manufacture or sale of all oleomargarine, but only such as is colored in imitation of yellow butter produced from pure unadulterated milk or cream of such milk. If free from coloration or ingredient that "causes it to look like butter," the right to sell it "in a separate and distinct form, and in such manner as will advise the consumer of its real character," is neither restricted nor prohibited. It appears, in this case, that oleomargarine, in its natural condition, is of "a light-yellowish color," and that the article sold by the accused was artificially colored "in imitation of yellow butter." Now, the real object of coloring oleomargarine so as to make it look like genuine butter is that it may appear to be what it is not, and thus induce unwary purchasers, who do not closely scrutinize the label upon the package in which it is contained, to buy it as and for butter produced from unadulterated milk or cream from such milk.

(The Court considered its own decisions, cited by the petitioner, in Railroad Company *v.* Husen, 95 U. S. 465, 473; Minnesota *v.* Barber, 136 U. S. 313, 322; Brimmer *v.* Rebman, 138 U. S. 78, 82, and Walling *v.* Michigan, 116 U. S. 446, 459, and proceeded as follows:)

It is obvious that none of the above cases presented the question now before us. Each of them involved the question whether one State could burden inter-State commerce by means of discriminations enforced for the benefit of its own products and industries at the expense of the products and industries of other States. It did not become material in any of them to inquire, nor did this court inquire, whether a State, in the exercise of its police powers, may protect the public against the deception and fraud that would be involved in the sale within its limits for purposes of food of a compound that had been so prepared as to make it appear to be what it was not. While in each of those cases it was held that the reserved police powers of the States could not control the prohibitions of the Federal Constitution nor the powers of the government it created (N. O. Gas Co. *v.* La. Light Co., 115 U. S. 650), it was distinctly stated that the grant to Congress of authority to regulate foreign and inter-State commerce did not involve a surrender by the States of their police powers. If the statute of Massachusetts had been so framed as to be applicable only to oleomargarine manufactured in other States, and which had been made in imitation of pure butter, the case would have been wholly different.

Referring to the general body of the law, from whatever source derived, existing in each State of the Union, and regulating the rights and duties of all within its jurisdiction, even those engaged in inter-State commerce, this Court said, in Smith *v.* Alabama, 124 U. S. 465, 476, that "it was in contemplation of the continued existence of this separate system of law in each State that the Constitution of the United States was framed and ordained with such legislative powers as are therein granted expressly or by reasonable implication." It was, consequently, held in that case that a State may enact laws and prescribe regulations, applicable to carriers engaged in inter-State and foreign commerce, to insure the safety of persons carried by them as well as the safety of persons and things liable to be affected by their acts while they were within the territorial jurisdiction of the State. If there be any subject over which it would seem the States ought to have plenary control, and the power to legislate in respect to which, it ought not to be supposed, was intended to be surrendered to the general Government, it is the protection of the people against fraud and deception in the sale of food products.

But the case most relied on by the petitioner to support the proposition that oleomargarine, being a recognized article of commerce, may be introduced into a State and there sold in original packages, without any restriction being imposed by the State upon such sale, is Leisy *v.* Hardin, 135 U. S. 100.

The majority of the Court in that case held that ardent spirits, distilled liquors, ale and beer were subjects of exchange, barter and traffic, and being articles of commerce, their sale while in the original packages in which they are carried from one State to another State, could not without the assent of Congress be forbidden by the latter State ; that the parties in that case, who took beer from Illinois into Iowa, had the right, under the Constitution of the United States, to sell it in Iowa in such original packages, any statute of that State to the contrary notwithstanding ; and that Iowa had no control over such beer until the original packages were broken and the beer in them became mingled in the common mass of property within its limits. "Up to that point of time," the Court said, "we hold that in the absence of Congressional permission to do so, the State had no power to interfere by seizure, or any other action in prohibition of importation and sale by the foreign or non-resident importer," p. 124.

It is sufficient to say of Leisy *v.* Hardin that it did not, in form or in substance, present the particular question now under consideration. The article which the majority of the court in that case held could be sold in Iowa in original packages, the statute of that State to the contrary notwithstanding, was beer manufactured in Illinois, and which had been shipped to the former State to be there sold in such packages. So far as the record disclosed, and so far as the contentions of the parties were concerned, the article there in question was what it appeared to be, namely, genuine beer, and not a liquid or drink colored artificially so as to cause it to look like beer. The language we have quoted from Leisy *v.* Hardin must be restrained in its application to the case actually presented for determination, and does not justify the broad contention that a State is powerless to prevent the sale of articles manufactured in or brought from another State, and subjects of traffic and commerce, if their sale may cheat the people into purchasing something they do not intend to buy, and which is wholly different from what its condition and appearance import.

On the contrary, in Rahrer's case, 140 U. S. 543, 545, 546, where this court sustained the validity of the Act of Congress of August 8th, 1890, 26 Stat. 313, c. 728, known as the Wilson Act, in the light of the decision in Leisy *v.* Hardin, it was said that "the power of the State to impose restraints and burdens upon persons and property in conservation and promotion of the public health, good order, and prosperity, is a power originally and always belonging to the States, not surrendered by them to the general Government not directly restrained by the Constitution of the United States, and essentially exclusive," and that "it is not to be doubted that the power to make the ordinary regulations of police remains with the individual States, and cannot be assumed by the National Government."

(In support of the judgment of the court below the court cites People *v.* Arenburg, 105, N. Y., 123, 129, 130, and other oleomargarine cases from Maryland, New Jersey, New Hampshire, Missouri and Minnesota. The court said in conclusion :)

It has therefore been adjudged that the States may legislate to prevent the spread of crime, and may exclude from their limits paupers, convicts, persons likely to become a public charge, and persons afflicted with contagious or infectious disease. These and other like things having immediate connection with the health, morals and safety of the people, may be done by the States in the exercise of the right of self-defence. And yet it is supposed that the owners of a compound which has been put in a condition to cheat the public into believing that it is a particular article of food in daily use and eagerly sought for by people in every condition of life, are protected by the Constitution in making a sale of it against the will of State in which it is offered for sale, because of the circumstance that it is in an original package, and has become a subject of ordinary traffic. We are unwilling to accept this view. We are of opinion that it is within the power of a State to exclude from its markets any compound manufactured in another State, which has been artificially colored or adulterated so as to cause it to look like an article of food in general use, and the sale of which may, by reason of such coloration or adulteration, cheat the general public into purchasing that which they may not intend to buy. The Constitution of the United States does not secure to any one the privilege of defrauding the public. The deception against which the statute of Massachusetts is aimed is an offence against society : and the States are as competent to protect their people against such offences or wrongs as they are to protect them against crimes or wrongs of more serious character. And this protection may be given without violating any right secured by the national Constitution, and without infringing the authority of the general Government. A State enactment forbidding the sale of deceitful imitations of articles of food in general use among the people does not abridge any privilege secured to citizens of the United States, nor, in any just sense, interfere with the freedom of commerce among the several States. It is legislation of the kind referred to in Gibbons *v.* Ogden, 9 Wheat. 203, which "can be most advantageously exercised by the States themselves."

We are not unmindful of the fact—indeed, this court has often had occasion to observe—that the acknowledged power of the States to protect the morals, the health and safety of their people by appropriate legislation, sometimes touches, in its exercise, the line separating the respective domains of National and State authority. But in view of the complex system of government which exists in this country, "presenting" as this court, speaking by Chief Justice Marshall, has said "the rare and difficult scheme of one general government, whose action extends over the whole, but which possesses only certain enumerated powers, and of numerous State governments, which retain and exercise all powers not delegated to the Union," the judiciary of the United States should not strike down a legislative enactment of a State – especially if it has direct connection with the social order, the health and morals of its people - unless such legislation plainly and palpably violates some right granted or secured by the national Constitution or encroaches upon the authority delegated to the United States for the attainment of objects of national concern. We cannot so adjudge in reference to the statute of Massachusetts, and as, in our opinion, the court below correctly held that the plaintiff in error was not restrained of his liberty in violation of the Constitution of the United States, the judgment is affirmed.

The Chief Justice and Justices Field and Brewer dissented. Chief Justice Fuller said:

The power vested in Congress to regulate commerce among the several States is the power to prescribe the rule by which that commerce is to be governed and, as that commerce is national in its character and must be governed by a uniform system, so long as Congress does not pass any law to regulate it, or allowing the States to do so, it thereby indicates its will that such commerce shall be free and untrammeled. Manifestly, whenever State legislation comes in conflict with that will, it must give way.

In whatever language such legislation may be framed, its purpose must be determined by its natural and reasonable effect, and the presumption that it was enacted in good faith cannot control the determination of the question whether it is or is not repugnant to the Constitution of the United States.

Upon this record it is conceded that oleomargarine is a wholesome, palatable and nutritious article of food, in no way deleterious to the public health or welfare. It is of the natural color of butter and looks like butter, and is often colored, as butter is, by harmless ingredients, a deeper yellow, to render it more attractive to consumers. The assumption that it is thus colored to make it appear to be a different article, generically, than it is, has no legal basis in this case to rest on. It cannot be denied that oleomargarine is a recognized article of commerce, and, moreover, it is regulated as such for revenue purposes by the Act of Congress of August 2d, 1886. (24 Stat. 209, c. 840.)

The Act under consideration prohibits its sale if "in imitation of yellow butter," though it may be sold "in separate and distinct form, and in such manner as will advise the consumer of its real character, free from coloration or ingredient that causes it to look like butter." This prohibits its sale in its natural state of light yellow, or when colored a deeper yellow, because in either case it looks like butter. The statute is not limited to imitations made for a fraudulent purpose, that is, intentionally made to deceive. The Act of Congress and numerous Acts of Massachusetts (Pub. Stat. Mass. c. 56; Stat. 1884, c. 310; Stat. 1886, c. 317; Stat. 1891, c. 412,) amply protect the public from the danger of being induced to purchase oleomargarine for butter. The Massachusetts laws minutely provide against deception in that respect, as well as any danger to the public health. The natural and reasonable effect of this statute is to prevent the sale of oleomargarine because it looks like butter. How this resemblance, although it might possibly mislead a purchaser, renders it any the less an article of commerce, it is difficult to see.

I deny that a State may exclude from commerce legitimate subjects of commercial dealings because their appearance may deceive purchasers in regard to their qualities.

The law of New Jersey was designed to compel the sale of oleomargarine on its merits, and for that reason certain distinctive marks were ordered to be placed on the tubs and vessels containing the article, and the makers were forbidden to artificially color it to resemble butter. It also provides that it shall only be sold from the original package, so that if a purchaser in buying butter has a suspicion that oleomargarine is being substituted for butter, by merely looking at the tub from which it is taken he can discover for himself if he is being imposed upon.

Relying on the provisions of the Inter-State Commerce act to protect them, wholesalers and agents of Western manufacturers brought large quantities of olemargarine into the State and sold it contrary to our statute. The decision of the United States Supreme Court above referred to will prevent this further infraction of the law, and consumers of the article will now be more fully protected against spurious butter than before As soon as the decision was announced I instructed my deputies to make a canvass of the State to detect any violations in respect to making packages, and at the time of writing this, prosecutions have been ordered against the only three wholesalers in the State, and the trial set down for January 10th.

MILK.

Since the enactment of the law approved March 15th, 1892, entitled "An act to prevent the adulteration and to regulate the sale of milk," and which was passed to stop the tampering with milk in vogue at that time, the inspection of this article has taken a wider and probably a much more important scope At one time adulteration was so common that nearly all the time of the inspectors was taken up in their endeavor to stop the illegal traffic. Since the appointment of the Dairy Commissioner in 1886 the practice has been growing gradually less, until now it is only occasionally that the inspectors report an infringement of the law.

In the practical accomplishment of this feature of the law the milk inspector was confronted with a condition existing in some sections of the State that was equally as serious if not as criminal as the actual adulteration of milk.

In my annual reports of the years 1890 and 1891 I called attention to the existence of what was known as swill stables in Hudson county, and the publicity given them at that time, together with the constant prodding the owners received by the inspectors, has entirely broken up their business of producing milk from swill feed, and I do not know of a single stable in the State where swill is fed to milch cows. There is a great necessity, however, for a rigid sanitary inspection at places where milk is produced for sale. In fact a large share of the time of the inspectors is taken up in this way. Frequent notices are received at this office from physicians, local boards of health and others interested in pure milk, of the existence of unsanitary cow-barns, sick cows or other conditions prejudicial to a pure milk-supply. Several notices were received during the past summer through which was traced sickness, and in two cases an epidemic of typhoid fever was traced to the use of infected milk.

It is to be regretted that very often considerable time elapses before this office is notified when a contagious disease attacks a dairyman's family, and much damage is done before we are able to discover and stop the sale of the infected milk. Physicians in charge of such cases should notify the local health boards immediately in such cases, and the inspectors of this department are ready to co-operate with such boards immediately on receiving notice. Copies of the reports made to me during the year of dairies inspected, together with samples of the milk produced, were sent to Professor Leeds, and his paper, page—gives such a comprehensive idea of the vast importance of this feature of milk inspection that it is not necessary for me to add to it. The infection of the milk causing the two epidemics referred to was found on analyses that the water on the premises of the dairymen was highly charged with chlorine and nitrates and utterly unfit for potable use. It is a singular fact that in every case where typhoid fever has been traced to the use of milk the water-supply has been condemned by the analyst. I am aware that according to the germ theory of physicians typhoid fever cannot occur unless the germ is transmitted to the person from a typhoid patient. Nevertheless I deem it very important from the experience I have had as an inspector to insist on a pure water-supply where it is used for washing milk-cans, or where there is a possibility of the water getting into the milk.

Table showing the number of milk samples collected in each county, in what town taken, the number above and below the State standard; also the highest and lowest in total solids:

ATLANTIC COUNTY.

Towns.	No. of samples.	Above standard.	Below standard.	Total solids. Highest.	Total so ids. Lowest.
Atlantic City, . . .	22	22	. .	13.25	12.60

BERGEN COUNTY.

Towns.	No. of samples.	Above standard.	Below standard.	Total solids. Highest.	Total so ids. Lowest.
Englewood, ...	16	16	. .	15.08	12.85

Towns.	No. of samples.	Above standard.	Below standard.	Total solids. Highest.	Total solids. Lowest.
BURLINGTON COUNTY.					
Beverly,	10	10	. .	12.90	12.45
Bordentown,	12	12	. .	22.64	12.04
Burlington,	6	6	. .	13.30	12.65
Cinnaminson,	8	. .	. .	. .	. .
Columbus,	4	2	. .	19.96	. .
Hartford,	4	4	. .	14.44	12.50
Kinkora,	20	20	. .	13.50	13.10
Mt. Holly,	2	2	. .	13.00	. .
New Lisbon,	2	2	. .	13.76	. .
Rancocas,	2	. .	. .	. .	. .
Riverside,	2	2	. .	12.50	. .
CAMDEN COUNTY.					
Camden,	84	84	. .	13.75	12 40
Clementon,	2	2	. .	. .	12.95
Laurel Station,	4	4	. .	13.35	13.15
Summerdale,	4	4	. .	13.50	13.30
CAPE MAY COUNTY.					
Ocean City,	14	14	. .	13.50	12.85
Sea Isle,	6	6	. .	13.15	12.95
CUMBERLAND COUNTY.					
Fairton,	4	4	. .	13.20	13.15
Greenwich,	2	2	. .	13.50	. .
ESSEX COUNTY.					
Bloomfield,	14	14	. .	14.20	13.50
Franklin,	2	2	. .	13.56	. .
Montclair,	34	32	. .	14.20	13.30
Orange,	22	22	. .	13.60	12.75
Verona,	14	. .	. .	. .	. .
GLOUCESTER COUNTY.					
Mullica Hill,	10	10	. .	13.50	13.25
Sewell Station,	2	2	. .	13.40	. .
Summerville,	2	2	. .	13.00	. .
Sherwin Station,	4	4	. .	13.60	13.10

Towns.	No. of samples.	Above standard.	Below standard.	Total solids. Highest.	To'al solids. Lowest.
HUDSON COUNTY.					
Hoboken, ...	22	.	2	. .	10.40
MERCER COUNTY.					
Ewing, ...	6	6	. .	14.10	12.00
Fernwood, ...	20	20	. .	15.16	13.76
Hamilton Square, .	4	4	. .	17.00	14.10
Princeton, ...	12	12	. .	13.60	12.75
Trenton, ...	108	58	10	15.82	6.80
MIDDLESEX COUNTY.					
Metuchen, ...	8	8	. .	13.60	13.00
Monmouth Junction,	2	. .	. .	. .	. .
New Brunswick, .	44	44	. .	13.60	12.05
MONMOUTH COUNTY.					
Asbury Park, . . .	84	80	4	13.90	9.51
Atlantic Highlands,	6	4	2	13.76	8.69
Belmar, ...	6	6	. .	13.30	12.90
Farmingdale, . . .	10	10	. .	13.40	12.75
Freehold, ...	2	2	. .	16.3	. .
Long Branch, . . .	46	46	. .	13.90	13.10
Manasquan, ...	2	. .	2	.	11.24
Red Bank, ...	24	24	. .	13.85	12.85
Sea Girt, ...	4	4	. .	13.05	12.00
Spring Lake, . . .	6	6	. .	13.50	12.95
MORRIS COUNTY.					
Morristown, . . .	24	.	.	.	. .
OCEAN COUNTY					
Bay Head, ...	8	8		13.88	13.32
Lakewood, . .	2	.	.	. .	. .
Point Pleasant, . .	16	12	4	13.80	10.83
PASSAIC COUNTY.					
Paterson, ...	4	2	2	13.10	9.80
SALEM COUNTY.					
Pilesgrove, ...	12	. .	. .	. .	. .

Towns.	No. of samples.	Above standard.	Below standard.	Total solids. Highest.	Total solids. Lowest.
SOMERSET COUNTY.					
Belle Mead, ...	22	22	. .	17.00	13.04
Bernardsville, . . .	6	. .	. .	. .	. .
Bound Brook, . . .	6	. .	. .	. .	. .
Harlingen, . .	2	. .	2	. .	11.40
North Plainfield, . .	6	6	. .	13.07	13.01
SUSSEX COUNTY.					
Branchville, . .	6	. .	. .	. .	11.98
Deckertown, . . .	4	. .	2	. .	9.10
Hamburg, ...	4	. .	4	. .	8.52
Stillwater, . . .	2	. .	2	. .	10.42
UNION COUNTY.					
Elizabeth, . . .	60	60	. .	14.05	12.36
Plainfield, ...	28	. .	. .	. .	. .
Roselle, ...	10	10	. .	12.60	12.00
Rahway, ...	2	. .	2	. .	11.90
WARREN COUNTY.					
Washington, . . .	8	8	. .	13.60	13.30

BOVINE TUBERCULOSIS.

In view of the action taken by other States and the widespread impression that tuberculosis in cattle prevailed in some sections of the State, thereby injuring the health and lives of the people, the Legislature enacted a law (see page —), which was approved May 4th, 1894, providing for a commission of five members to investigate the extent of the disease and granting them certain powers to cope with the same. My official relation to this law will be seen in the first section of the act, which says that "at the request of two members of the State Board of Health, or the State Dairy Commissioner, or the owner of suspected animals, the commission on tuberculosis shall investigate and enforce such measures as they deem proper." President Edward Burrough, of the State Board of Agriculture, appointed the following gentlemen to serve on the commission: Charles Howell Cook, William H. Parry, M.D., Isaac W. Nicholson, Esq., Joseph B. Ward, M.D., and Franklin Dye, Esq. The commission organized July 24th, 1894, and have been diligently at work ever since performing the duties prescribed by the statute. President Burrough deserves credit for his wise selection of the men who are to deal with a subject that has provoked so much criticism for the past few years; and, judging from the character of the work already performed, should the enforcement of the law remain in their hands, farmers and cattle-breeders and the consumers of milk will alike be protected and the public will be impartially and truthfully informed.

At the first meeting of the Board a resolution was passed inviting the State Dairy Commissioner to meet with the Board and co-operate with them in their labors. I was subsequently requested to furnish, from data already in my office, a list of dairies exhibiting the following conditions:

1st. Where sanitary and feeding conditions are positively bad.

2d. Where sanitary and feeding conditions are good, but where close inbreeding has been practiced on pure-bred animals

3d. Natives. Where natural conditions are observed both in relation to feed and shelter.

The large number of sanitary inspections of dairies made during the last two years enabled me to comply with the request. I detailed an inspector, however, to visit a considerable number of dairies in addition, in order to give the Board the information relating to such typical herds as they had desired. Great care was exercised to select such herds as would supply the most reliable and complete data. I furnished the Board with the list referred to, selecting the herds as follows :

LIST NO. 1.

Location.	No of cows in herd.
Salem County—	
Woodstown,	28
Woodstown,	30
Sussex County—Augusta,	47
Monmouth County Freehold,	16
Total,	121

LIST NO. 2.

Hudson County –	
Arlington,	12
Arlington,	12
Jersey City,	23
Jersey City,	8
Jersey City,	8
Sussex County—	
Stillwater,	18
Verona,	15
Salem County	
Pilesgrove Township,	14
Salem County,	14
Essex County—	
Newark,	10
Newark,	10
Newark,	17
Newark,	4
Caldwell,.	10
Monmouth County Atlantic Highlands,	18
Total,	193

LIST NO. 3.

L cation.	No. of Cows in herd.
Essex County	
Caldwell,	180
Arlington,	29
Livingston,	50
Newark,	18
Burlington County—Moorestown,	50
Passaic County—Manchester,	21
Hudson County –	
Secaucus,	11
Secaucus,	135
Secaucus,	150
Morris County –	
Morristown,	40
Morristown,	74
Morristown,	84
Mercer County—	
Asylum,	49
Lawrence Township,	14
Somerset County	
Bernardsville,	30
North Plainfield,	30
Sussex County—	
Branchville,	14
Middletown,	22
Augusta,	47
Salem County –	
Daretown,	20
Salem,	18
Monmouth County – New Monmouth,	7
Total,	1,084

Since that time I have requested the examination of other herds, but, as the details of the work will appear in the report of the commission now being prepared, it is obviously unnecessary for me to go into details in this place.

The Philadelphia Board of Health passed an ordinance during the past summer requiring all milch cows supplying milk in the city to undergo the tuberculin test, under penalty in case of non-compliance of declaring the milk unwholesome. This action by the above board was considered in many quarters unjust. The dairymen in their own

State, as well as those of New Jersey, protested against what they considered a very arbitrary proceeding.

There are conflicting opinions among the scientists who have studied the subject of bovine tuberculosis as to whether the use of tuberculin should be made a legal diagnostic agent. In other words, should any veterinarian be legally empowered to enter upon the premises of our dairymen and condemn a part or the whole of his herd, having injected the lymph on the strength of the evidence supplied by the tuberculin test?

In other States where laws exist for eradicating the disease by slaughtering all more or less tubercular animals (notably in Massachusetts), the result has proven disastrous to the dairymen, and it promises to be until the States shall pay full indemnity to the owners and establish a system of quarantine against all cattle imported into that State. Do the facts warrant such extreme measures when most of the highest authorities agree that the tubercle bacillus is seldom present in the milk and only when the disease has invaded the udder?

Dr. Bridge, the veterinarian of the Pennsylvania State Board of Agriculture, says: "While I advocate the use of tuberculin for the testing of herds for tuberculosis, I would not advise its indiscriminate use in every herd; nor is it necessary. Without it the badly diseased could not be detected, yet there are herds where its use is not called for. Some herds may average as high as fifty or one hundred per cent. of diseased, while others will not average more than one or two per cent., and others are absolutely free. If after a careful and thorough examination by a competent veterinarian the disease is found or suspected, it would be wise to test with tuberculin, but where tuberculosis is not found or suspected I would not counsel its use. Our knowledge of tuberculin as yet is imperfect. In some cases it has been known to produce a rise of temperature where no tuberculosis existed, and in others gave no reaction in advanced cases of the disease. Therefore, until we are sure of our deductions from reactions of temperatures, errors will occur and farmers suffer needless loss. The testing should be done with the greatest skill and caution. The dairymen have rights as well as the public. The milk from tuberculous animals is not so frequently infected as is supposed.

Milk from animals in the earlier stages of the disease and with perfect udders does not contain tubercle bacilli. Therefore, a careful physical examination, with the use of tuberculin if it is thought necessary, will be sufficient, and will protect the public health."

The late Dr. Henry F. Formad, of the University of Pennsylvania, in commenting on the examinations of the specimens from three tuberculous cows and one calf sent him by myself in June and July, 1891, including the udders and various samples of the milk from the same cows, remarked: "The tubercle bacilli being the established poison of tuberculosis, the observations of the three cases recorded conclusively prove that in spite of tuberculosis of internal organs the milk was not contaminated. The reason for this is, I think, that the udders were normal. I think that it is only when the udder is highly tubercular (which fact could be easily established in the living animals by examining the udder and its surroundings for enlarged lymph glands) there would be risk from the milk."

It has been proposed that the present chemical examination of milk for adulteration should be supplemented by a bacteriological examination for the tubercle bacillus on the supposition that such an examination in every case would be conclusive and satisfactory. But such is not the case, nor would the proposition have been made if the very different nature of the evidence obtainable by chemical and that obtainable by bacteriological examination had been more completely understood.

In the ordinary inspection directed usually to determining whether or not the milk is adulterated by the addition of water, or by the removal of cream, or by the aid of any foreign substance, a trained inspector is able in the great majority of cases to determine the fact of adulteration by the physical characters of the milk. There then remained only a very limited number of cases in which it is necessary for him to take a proper sample and transmit it to a public analyst for chemical analysis. Now the processes of chemical analysis of milk are such as have been in use for many years; their accuracy has been verified by tens of thousands of analyses, and the testimony supplied by them is final and conclusive, and is accepted as such by dairymen, the public and by courts of law.

But the case is entirely different when the inspector is requested to examine milk for the existence of tuberculosis. He receives no help from the physical characters and appearance of the milk It may be rich and creamy-looking; it may have a sweet, pleasant taste; it may be normal in all respects, and have a large percentage of fat and solid substance. In short, it may be excellent milk so far as a physical and chemical examination can be made to extend, and yet contain the tubercle bacillus. Not being himself able to decide, the inspector would be compelled to submit a vast number of samples to the bacteriologist. Here, however, a still greater difficulty is encountered. The processes of bacteriology as applied to the detection of bacillus of bovine tuberculosis in milk have been discovered only during the past few years. They have not been subject to the chemical proofs of accuracy necessary to establish their reliability in all cases. Only when the infection of the milk is well pronounced do they afford evidence which is reasonably conclusive and which can be obtained by the expenditure of a limited amount of time. In the vast majority of cases the bacteriological examinations of the milk for the tubercle bacillus yields results which are either doubtful or negative. This is the case even after a great deal of time and infinite pains and precaution have been expended in conducting the examination. In fact, in these doubtful cases it is necessary to have recourse to the process of innoculation of a lower animal, like a guinea-pig, with a sample of the suspected milk, and then wait a number of weeks to see if the animal is attacked with the disease.

For these reasons the inspection of milk must begin at the dairy, and must be entrusted to the veterinarian. If he find that the disease has advanced to a stage that the milk is liable to be affected, according to the best knowledge we have on the subject at the present time, then the animal should be slaughtered and the owner indemnified. If, on the contrary, he find animals in a condition of less advanced disease, he would have to decide in each particular instance what would be the wisest course to pursue. Practical action should certainly never be taken until the scientific information within our reach warrants it, and just at present we are waiting for the light which the investigation of the commission, and from other sources, will provide us.

The surest way to reach a perfect milk-supply, in my opinion, is by a canvass of every dairy farm in the State, and in case the results warrant it a proper certificate of dairy inspection should be made out for a definite time by the Dairy Commissioner—the same to embrace the physical condition of the cattle as determined by a competent veterinarian, the quality of the food and water-supply, and the hygienic condition of the general surroundings. Such certificates of dairy inspection would prove of great value to the dairymen on the one hand, and would guarantee to the public that the inspection had been begun where in all cases it properly should—with the animals in the dairy.

CREAMERIES.

I have endeavored to obtain statistics showing the consumption and production of milk annually delivered to the creameries and milk receiving stations in the State, and with that object in view I forwarded blanks to each creamery with a request that they be filled out and returned. I have only received, however, returns from thirty-three creameries.

During the next year I will continue my efforts to secure reliable statistics of this industry. I have found that the price paid for milk varies considerably. The average appears to be two and one-half cents per quart, the farmer being allowed to take away the skim milk at a cost to him of ten cents per forty-quart can. At some creameries the rate paid for milk is based on the percentage of butter fats contained in the milk, and seems to be the most equitable to both producer and consumer and conduces to the production of a better quality of milk, and consequently an improvement in the grade of milch cows.

The price received for butter is reported as from twenty to thirty cents per pound, or an average of twenty-four cents. At many creameries no butter is made during the summer months, the cream being disposed of to ice cream manufacturers in large cities. Cheese in limited quantities is also produced.

According to the reports received from thirty-three creameries it is found that the number of patrons supplying milk to them is 1,055. The annual milk receipts are 88,078,888 quarts; butter production annually, 292,688 pounds; cheese production annually, 133,680 pounds. The average price of milk per quart, 2.04 cents; average price received for butter, 24 cents. The production of condensed milk annually, 221,606 quarts. Valuation of plants, $153,000. Price received{for cheese per pound, 5 cents. The majority of these creameries have been visited by the inspectors during the past year for the purpose of testing the milk received, and in many instances samples have been taken for chemical analyses. It is gratifying to state—and it speaks highly for the patrons of these creameries—that in but very few instances has the milk fallen below the State standard. The establishment of these creameries in the State has proven of great value and convenience to the farming community, and they are steadily increasing in number.

There are about seventy-five creameries scattered throughout the the State, representing an investment of over $300,000. Many of these are owned by private parties and some have been established and conducted by dairy associations representing the farmers of the neighborhood

Below will be found a table giving data as collected by circulars sent out by this department and referred to above :

PROPRIETOR.	LOCATION.	Number of Patrons.	Annual Milk (qts.) Receipts.	Annual Butter (lbs.) Production.	Annual Cheese (lbs.) Production.	Price per qt. Paid for Milk.	Price Received for Butter.	Annual Condensed Milk Production (qts.).	Valuation of Plant.	Price Received per lb. for Cheese.
Geo. Winken,	Sparta, Sussex County,	12	219,000			.03			$2,000	
Sussex County C. M. C. Co.,	Deckertown, Sussex County,	64	800,000		40,000	.02½		80,000	25,000	.04½
Sussex County C. M. C Co.,	Hamburg, Sussex County,	50	840,000	25,000	40,000	.02½	.24½		8,000	.05
Inken & June,	Stockholm, Sussex County,	18	365,000						2,000	
T. O. Smith Sons,	Augusta, Sussex County,	25	730,000			02½			4,500	
S. C. Hayne,	Clover Valley, Sussex County,		288,000						3,000	
W. E. Rogers & Co.,	Hamburg, Sussex County,		342,018	400			20		3,500	
Brown & Bailey,	Glenwood, Sussex County,	28	1,034,450	17,227	4,000			134,000	20,000	
J. H. Muchler,	Stillwater, Sussex County,	35	864,000	60,000		.02			2,500	
Reardon & Doremus,	Deckertown, Sussex County,	20	511,000			.02½				
Wright Bros.,	Andover, Sussex County,	13	540,000	1,000		.02¼	.25		3,500	
F. W. Fulboam,	Branchville, Sussex County,	43	1,440,000	5,000		.02¼	21		2,500	
Geo. Winken,	Vail, Sussex County,	43	584,000	9,600		.02¼	20		3,000	
Pound & Jordan,	Marksboro, Sussex County,	30	720,000			.02½			1,700	
J. T. Force,	High Bridge, Hunterdon County,	5	100,000			.02¼			1,500	
J. T. Force,	Glen Gardner, Hunterdon County,	13	206,520			02¼			1,000	
Clinton M. & C. Co.,	Clinton, Hunterdon County,	32	610,004	1,500		.02⅜	.22		1,000	
F. J. Seelig,	West Neshanic, Hunterdon County,	25	576,000			.02			4,000	
J. H. Vanler,	Friesburg, Salem County,	50	172,600	16,800		.02½				
L. E. Mack,	Daretown, Salem County,	35	1,200,000							
Bruna Creamery Co.,	Salem, Salem County,	50	400,000			.02½			15,000	
Pilesgrove Dairy Association,	Woodstown, Salem County,	60	891,688	63,229		03⅓	.30	7,606	3,000	
H. B. Richmen,	Mannington, Salem County,	20	300,000	23,000		02½	.24½		2,[illegible]00	
Jos. N. Reeve,	Woodstown, Salem County,	110	2,401,200			.02½	.25		13,400	
Dairy Association	Allentown, Monmouth County,	54	654,000	34,232	49,680	.02½	.25		4,500	
W. B. Plaskett,	Hartford, Burlington County,	22	300,000			02¾	.28		900	
S. M. Ogden,	Bridgeton, Cumberland County,	95	640,000	35,000		02½	.28		9,000	
J. Lohman,	Bloombury, Hunterdon County,	6	144,000			02¼			2,000	
Geo. Clark,	Lebanon, Hunterdon County,	30	876,000			.02⅓			3,000	
Consolidated Milk Co.,	Hopewell, Mercer County,	24	346,000			.02½			1,500	
Consolidated Milk Co.,	Skillman, Mercer County,	18	320,000			.02½			2,500	
C. T. Smith,	Annandale, Hunterdon County,	21	520,000	700		.02⅓	.18		5,000	
	Vernon, Sussex County,	14	474,400			.01½			2,500	

FOOD AND DRUGS.

My relation to the law regarding the adulteration and sale of food and drugs is co-operative with the State Board of Health.

My corps of inspectors are instructed in making their investigations under the milk and oleomargarine acts to take notice of any violation of this law and report the same to me. When I am informed of any such violation I immediately report the same to the State Board of Health, and make such investigation as they may direct and report to them the results.

Under this law one hundred and forty-two samples have been collected and analyzed the past year. One conviction for the sale of imitation coffee was had at Newark and the fine collected.

REPORT OF ANALYSES

Made for the Year Ending December 31st, 1894---Food, Drug and Milk Acts.

BY SHIPPEN WALLACE, CHEMIST.

Mr. George W. McGuire, State Dairy Commissioner:

DEAR SIR—I have the honor to submit my report on the analyses made by me of milk, food and drugs for the year ending December 31st, 1894.

I received 2,002 samples in all, they being as follows:

Milk,	1,034
Condensed Milk,	5
Butter,	836
Water,	75
Preserves,	18
Catsups,	20
Chocolates,	7
Cocoa,	7

MILK.

During the past year there have been more milk analyses made than in any year previous. Of the 1,034 samples analyzed, 63 were found to be below the standard of 12 per cent milk solids. The average of all samples is 13 62 per cent. milk solids, showing that the standard is entirely too low. Since the law was passed, in 1882, there has been a decided increase in the sale of Jersey milk in the city of Philadelphia, and while at that time there was a very strong opposition by the producers in South Jersey as well as the dealers, at the present time it is difficult to find an opponent to the law. Why this increase in the sale of Jersey milk should be, is a question. It is probable that the dealers of Philadelphia found that owing to the law of our State they were assured of a better quality of milk than what they could obtain from Pennsylvania, where they had no such law. There has been a steady diminution in the milk receipts of the Pennsylvania system in Philadelphia for several years past, while there has been a decided increase in the receipts at their Camden station. For the year ending December 31st, 1894, the milk receipts at Camden amounted to 20,585,680 quarts, while the receipts in Philadelphia for the same time were 18,852,590 quarts. The receipts in Camden show an increase of over 25 per cent. since the year 1890. There has also been a decrease in the amount of milk received by the other roads centering in Philadelphia, and while the amount consumed has increased, this increase has come from New Jersey. The method of analysis pursued has been the same as has been mentioned in detail in previous reports. There has been no attempt made to follow so-termed quick methods, since, as a rule, they are inaccurate, and the method followed is so simple that when one considers the slight increase of time, the knowledge that the results will be accurate is fully made up for.

CONDENSED MILKS.

There were five samples of condensed milk analyzed. There has as yet been no legal standard fixed as to the composition of this article. The claim made by the manufacturers of the extent to which the original milk has been condensed is, as a rule, high. There can be no doubt that condensed milk when properly made is a good article, since in the mode of manufacture the milk is cleansed of all impurities. One canvasser whom I met had in his possession as an argument for the purchase of his condensed milk in preference to uncondensed milk a piece of cloth taken from the centrifugal machine through which the milk passed. This cloth was thickly coated with a quantity of stuff which had been taken from the milk which his parties had bought, consisting of small particles of hair, pieces of skin which had come probably from the milker's hands, and dirt.

The following table shows the result of the analyses and the name of the brand analyzed:

CONDENSED MILK ANALYSES.

Brand.	Water.	Fat.	Casein.	Milk Sugar.	Cane Sugar	Ash.	Milk Solids.	Times Cond's'd.
Bell, ...	26.75	10.40	9.40	16.90	34.95	1.60	38.30	3.06
Pansy, . . .	26.48	10.30	9.10	13.50	38.67	1.95	34.85	2.74
Magnolia, .	27.10	10.80	9.05	15.40	35.85	1.80	37.05	2.96
Lily, . . .	28.75	11.12	8.05	15.50	34.28	2.30	36.97	2.95
Howell's, . .	65.50	10.30	10.90	11.40	. .	1.90	34.50	2.76

The column headed "Times Condensed" is obtained by dividing the milk solids by 12.5, which is assumed to be the minimum amount which pure herd milk will contain of milk solids. All the samples, with the exception of one, contained cane sugar. This is, as a rule, made use of in all condensed milks, it being claimed to be necessary in order to keep them. Lately, however, they have been endeavoring, and they have on the market simply condensed milk containing no cane sugar, which it is claimed has many advantages and will keep as well if not better than those containing cane sugar.

WATER

There were seventy-five samples of water analyzed, the bulk of them coming from dairies the milk from which was supposed to produce typhoid fever. In a number of instances the samples were found to be badly contaminated.

PRESERVES.

There were eighteen samples of preserves, consisting of raspberry, blackberry, pineapple, strawberry, and quince. These samples were as a rule made with glucose, there being but a small amount of cane sugar used. They were also quite heavily charged with salicylic acid, this being used as a preservative. The use of salicylic acid is quite common, and whether it should be allowed or not is a debatable question. Salicylic acid is not a normal constituent of any common food, and its addition to such food for any purpose and in any quantity without due notice to the consumer is plainly adulteration. If any man desires to have salicylic acid in his food there is no doubt of his right to have it, but the manufacturer should have it marked on his label. Several European governments have forbidden its use. France prohibited it in 1881 and has since renewed the prohibition. There has been a great deal of discussion as to the propriety of its use, and a special committee of the Paris Academy of Medicine reported that while persons in good health might suffer no injury from the use of such small amounts as are liable to be contained in food, this did not necessarily hold good for the aged or for those of feeble health, and they recommended that the addition to food of salicylic acid or its salts, even in small amounts, be absolutely prohibited.

The twenty samples of catsup examined contained salicylic acid. This I find to be the rule with all samples found in the market, at the same time considering how cheap the ingredients, which are as a rule obtained from canning houses, being, as one might say, the refuse from the tomatoes, it is surprising to find that the article is frequently adulterated by the use of apple pumace, starch and unknown substances.

CHOCOLATES AND COCOA.

There were seven samples of chocolate, unsweetened, analyzed, and the same number of cocoas.

Chocolate is frequently adulterated with foreign starches and cane sugar. Whether the addition of cane sugar can be termed an adulterant is questionable. It probably cannot be when it is sold as sweetened chocolate, but the addition of foreign starches certainly is.

The following table shows the brands analyzed :

Name.	Foreign starches.	Moisture.	Fat.	Ash.
Baker's Chocolate,	Wheat.	3.09	49.81	3.08
Wilbur's Chocolate,	Wheat.	3.82	49.40	3.18
Maillard's Chocolote,	None.	3.18	50.84	3.44
Rockwood Chocolate,	Wheat.	3.17	45.21	3.19
Huyler's Chocalate,	None.	2.70	30.01	3.69
Miller & Son's Chocolate,	None.	3.01	50.50	3.30
Baker's Cocoa,	None.		32.52	4.20
Baker's Breakfast Cocoa,	None.		25.83	5.05
Wilbur's Cocoa,	None.		30.70	4.54
Miller & Son's Cocoa,	None.		24.45	5.27
Van Houten's Cocoa,	None.		29.81	8.64
Epps' Prepared Cocoa,	Arrowroot, Cane sugar.		29.94	3.15

With the exception of Epps' Prepared Cocoa none of the above contained cane sugar.

With the lower grades of chocolates it is frequently the case to find that the cocoa fat has been extracted and another fat made use of. The reason for this is that the cocoa fat, or butter, as it is called, is of more value than the substitutes.

BUTTER.

Eight hundred and thirty-six samples of suspected butter were analyzed, 120 of which were found to be oleomargarine, in some cases colored with annatto, but as a rule this was not the case. While to the eye there is no difference in the appearance of oleomargarine and butter, this appearance does not necessarily come from annatto. The manufacturers have a method which is more or less secret to make their product resemble butter, and they claim that the color so obtained comes from ingredients necessary in its manufacture. Some years since it was decided by the Supreme Court of New Jersey that if the color was so obtained it did not violate the law. It certainly, however, seems to violate the intent of the law, which was that it should not have any resemblance to butter. Oleomargarine is now sold by a great number of dealers without the slightest attempt to deceive. This has been brought about by the strict enforcement of the law and by the fact that a number prefer it to butter at the same price, but not as well tasting. Several local papers publish advertisements of grocers who sell the article.

All of which is respectfully submitted,

SHIPPEN WALLACE,
Chemist.

BURLINGTON, January 15th, 1895.

AN EPIDEMIC OF TYPHOID FEVER

At Bay Head, N. J.,

During July, 1894, and From Direct Infection of a Milk-Supply.

BY W. K. KATZENBACH, M.D.

During July, 1894, an epidemic of typhoid fever, embracing fifteen cases, broke out in Bay Head. Of this number four were males and eleven females, and of the latter six were domestic servants. The youngest was a boy four and one-half years of age, the oldest a female servant aged thirty-five years. There were no deaths. The first case was Fred. J., aged twenty-one, who brought a herd of eight or ten cows from Whitesville about the middle of June. He stalled and pastured the cows on the farm of Mr. H., about a quarter of a mile west of the railroad station, and sold the milk to Mr. C., of Point Pleasant, who distributed it among the cottages in Bay Head, none of it being taken to Point Pleasant. The other cases, fourteen in number, drank milk supplied by Mr C., and no cases of the fever appeared in the cottages supplied by the other two dealers. Mr. C. bought milk from Fred. J. and from the Milk Dealers' Association of Camden, N. J., which he sold in Bay Head only; and from Mr. C. and from Mr. R., which he supplied to families in Point Pleasant only. No cases of the fever appeared in the latter place.

Fred. J. was taken ill about July 1st. He complained of headache, constipation (for which he was obliged to take cathartic), and abdominal pains. He had three attacks of nose-bleed. He was visited by the writer in the evening of July 13th, when he had a temperature of 102.50 and presented all of the signs of typhoid fever, including the eruption. He had milked his cows every day until July 11th, when he took to his bed. He was under the care of Dr. Tunis, of Manasquan, and the writer saw him professionally July 13th, on account of Dr. Tunis' inability to visit him on that day.

July 14th he was removed to his home in Whitesville, where soon after his sister was attacked with the same disease. They both recovered. Mr. C. continued the purchase and sale of Fred. J.'s milk until July 22d. Seven of the cows were taken back to Whitesville July 24th or 25th.

The first case from this source was seen by the writer July 14th in the person of a waitress, aged twenty, who had been in Bay Head one month and who had been drinking milk supplied by Mr. C From this date until July 23d, when the State Board of Health was notified, five other cases occurred, all the patients being consumers of Mr. C.'s milk.

Mr. George W McGuire, State Dairy and Food Commissioner, visited Bay Head July 25th, and after a careful investigation took samples of the milk from Fred. J.'s remaining cows for bacteriological examination, and also samples of water from the wells on the farms from which Mr. C. received milk for analysis. July 27th, Dr. A. Clark Hunt, member of the State Board of Health, inspected the cottages in which the cases occurred and were occurring and examined their plumbing, drains and cesspools, in the company of the writer and Dr. D. J. Milton Miller.

Included in the fifteen cases was that of G. P., aged twenty-four, driver of Mr. C's wagon Thirteen cases appeared in ten summer cottages, three having two cases each Mr. C. supplied forty-eight cottages—about half of the borough—with milk. His driver's custom was to start out with Fred J.'s and the Camden milk in separate cans, and beginning with one would "run it out" and then serve from the other. When the milk was exhausted the empty cans were taken to Point Pleasant, where they were cleaned with water from Mr. C.'s well. They were not washed again before receiving the next supply of milk. At any rate the can which was returned to Fred. J. did not receive such treatment. From these facts and that no cases appeared in Mr C.'s family, nor on the farms whence he received milk for distribution in Point Pleasant, nor in the families in Point Pleasant receiving milk from Mr. C., the probability of the milk being infected from infected water cannot be excluded.

Bay Head receives its water from two artesian wells, one over 700 the other over 900 feet deep, supplying about seventy gallons a minute. This is carried through pipes to every cottage east of the railroad. An analysis showed it to be perfectly pure.

The inevitable conclusion is that Fred. J. directly infected the milk with his hands in the process of milking The first case appeared in Bay Head, July 14th, fourteen days after he began to complain and three days after he went to bed The last case on July 30th, nineteen days after he stopped milking the cows and only eight days after the sale of his milk was stopped. A servant (July 2d) who was slightly ill when she left for Philadelphia, July 2d, was attacked in that city, July 17th, with typhoid fever. None of the cases was fatal. Three had one relapse each ; one was complicated in the relapse with thrombosis of the leg, and one with abscesses on each buttock and under the chin. None, as far as I could learn, had intestrual hæmorrhage. In every case the correctness of the diagnosis was verified. The patients were attended by Dr. B. F Hawley, Dr. D. J. Milton Miller and the writer, of Bay Head ; Dr Tunis, of Manasquan, and Dr. Whitaker, of Point Pleasant.

DAIRYING

In Its Relations to the Inspection of Milk.

BY PROF. ALBERT R. LEEDS, PH.D.

The importance of improving and increasing every instrumentality by which the quantity and quality of our dairy products may be still further augmented may be best realized by considering to what vast proportions this industry has already grown in the United States. It has been computed that three-quarters of a million of men are engaged in the various departments of milk production and handling; that over fifteen million milch cattle are owned by our four million farmers, and that they produce annually nearly seven thousand million gallons of milk. The aggregate capital invested in dairying exceeds two thousand millions of dollars.

What fraction of this enormous total is represented by the State of New Jersey will be known when the statistics which have been accumulating during the past two years are completed. But the fraction is a large one in proportion to the entire population of the State. The various reports of the State Geological Survey show that the southern limit of the drift formation extends well down into the State, giving a great area of pasture-lands especially fitted for grazing. This natural adaptation, together with the location of its pasture-lands between the two greatest cities on the seaboard, make its daily industry, especially its fresh market-milk, of the first importance.

Similar considerations apply to the capital interested in its creameries, the number of which is large and constantly increasing; also to the quantity of milk and dairy products transported by the railroads and to the number of men employed more or less directly in handling These statistics, as well as those relating to the production of milk sugar and of condensed milk of various kinds, are in course of preparation

It would be difficult to overestimate the benefits conferred upon the dairy interests of the State by the work of the milk inspectors under the supervision of the State Dairy Commissioners since the passage of the first law relating to the adulteration of milk in the year 1880. That law had for its immediate object the prevention of the frauds practiced on the consumer, but it has also resulted indirectly in bringing a great benefit to the dairyman by enforcing improvements in the practical conduct of the dairy.

The watering of milk to such an extent as to bring it below the State standard, which was a fraud mostly practiced by the dealers, was so common that, at the outset, the inspectors had their hands full conducting prosecutions. Now it is difficult for the inspectors to find a case. The artificial coloring of milk, which was quite a common practice before 1880, has practically been put an end to by the inspections and subsequent chemical examinations. Much partially skimmed milk is still sold in this State as whole milk, and this will continue to be the case until the percentage of fat is regulated by law and fixed at a minimum of 3.5 per cent.

But the standard of 12 per cent. of solids is so low that most whole milk can be watered—and much is—with great precision, so as to just escape the penalties of the law. It is necessary to begin the work of inspection at the dairy. In Hudson and Essex counties nearly 2,500 stables were found by the inspectors, in most of which the cattle were kept in a crowded and unhealthy condition and in which the principal food was wet and partially soured brewers' grains.

Though the present law intended to prevent the keeping and feeding of cattle under disease-producing conditions is too general in its provisions to permit of successful prosecutions for its infringement, yet by the pressure brought to bear by the inspectors, by the wide publicity and popular indignation consequent upon their reports, and the stirring up of the local boards of health to exercise some supervision and care in the issue of licenses, the worst of the evils complained of have been rectified. They will not entirely disappear until more stringent laws and ordinances have been passed and the keeping of dairies in closely-inhabited districts is regulated by a proper system of licenses.

But leaving these dairies, infamous alike in their cruelty to animals, in their brutalizing influences upon men, and in their disease-spreading effects upon infants and the general community, let us consider the great benefit of the inspectorial work upon dairying wherever carried on with honest effort. In hundreds of cases the location of the wells and the sources of water have been examined, and, wherever advisable, the purity and suitableness of the water ascertained by analysis. The drainage, ventilation and sanitation of the yards, outhouses and buildings have been looked into. The duties of the inspectors carrying them to all parts of the State, they have made known the results of successful feeding experiments at one dairy and reported and compared the results there obtained with those secured at a multitude of others. The influence of devoted care and watchful supervision of the individual animal in all points referring to its comfort, cleanliness, skillful feeding, proper breeding, etc., have been made manifest in numberless instances, and the rich rewards of this intelligent personal attention to each individual of the herd been constantly insisted upon. For reasons previously given, the fixing of the standard at 12 per cent. of solids has done much towards bettering the conditions of milk-production all over the State, but raising the standard to 12.5 per cent., with a minimum 3.5 per cent. of fat, would do a vast deal more. A general improvement in breeding, feeding, and in the application of knowledge and skill, now too frequently neglected, would speedily follow.

Certainly, in view of the above considerations, we cannot well overestimate the importance of adding to our knowledge upon all subjects relating to dairying, and, what is scarcely less important, the bringing of this knowledge into familiar and daily use in the dairy.

II.—SOURCES OF INFORMATION.

The sources of our knowledge relating to dairying are principally as follows:

1. Experience in dairying in Holland, Germany, France, and England, but more especially experience in the practical conduct of dairy farms as managed in our own country.

Much of this knowledge thus acquirdd has been recorded in manuals and encyclopædias of agriculture. A large portion, however, will always remain unwritten and will be known only to those who make dairying the daily business of their lives. The object of this article is not to refer to this already recorded or generally received knowledge, but rather to the additions which are being made to it by experiments and researches and to the publications in which these additions may be found.

2. The publications of the United States Government, of foreign governments and the various States.

The most important of the publications by our own government are those issued by the Department of Agriculture, and more especially those coming from the office of Experiment Stations. Of the latter there are two classes:

First—Experiment Station Records, Experiment Station Bulletins and Miscellaneous Bulletins.

The Records are principally devoted to summarizing the results obtained at the Agricultural Experiment Stations. According to the "Handbook of Experiment Station Work," which is a popular digest of the publications of these stations, and which is itself issued as "Bulletin No. 15 of the U. S. Office of Experiment Stations," there were in the year 1892 fifty-four stations in the various States and Territories. They were organized in 1887 by act of Congress, according to which $15,000 is given annually to each State for their maintenance. In 1892 their annual revenues amounted to $997,244, of which $389,542 was given by the general government, the remainder coming from the States, from fees, sales of farm products, etc. These funds supported about 500 officers and assistants, including 68 directors, 115 chemists, 54 agriculturists, 59 horticulturists, 36 botanists, 36 entomologists, 23 veterinarians, 14 meteorologists, 9 physicists, 4 geologists, and 3 engineers. They published 55 annual reports and 250 bulletins, and distributed their publications to nearly 400,000 people. The most important matters contained in these reports and bulletins are brought together and preserved in the U. S. Experiment Station Records, of which the sixth volume is now being issued.

The Experiment Station Bulletins are fifteen in number, of which the most important in relation to dairying are No. 9, "The Fermentations of Milk;" No. 11, "A Compilation of Analyses of American Feeding Stuffs," and No. 15, the handbook alluded to above.

The Miscellaneous Bulletins are more especially devoted to convention proceedings, and contain only incidental references to dairying.

All of these records and bulletins are more or less technical, and contain a great number of chemical analyses and details of scientific investigations, as well as statements of a more practical character. The latter are enlarged upon in a separate class of publications, known as—

Second—Farmers' Bulletins. Of these should be especially mentioned in the present connection No 9, "Milk Fermentations and Their Relation to Dairying."

As to the publications of foreign governments, these also are so fully summarized in the Records that little of importance to the dairyman is omitted. Such being the case, the Records have formed the most convenient and valuable source of information accessible to the writer and have been freely consulted and drawn upon.

In addition, a vast deal of information is to be found in the United States Census, in the elaborate reports upon the great international exhibitions at Vienna and Paris, and in its consular reports

More especially in a volume of 900 pages, consisting of reports by our consuls and by experts in all parts of the world upon "Cattle and Dairy Farming," Washington, 1887, and transmitted along with much valuable information by the Secretary of State to the House of Representatives, there is a vast accumulation of facts and suggestions which are worthy of most careful attention.

The Secretary of State, for instance, calls particular attention to the recommendations of our consul at Liege, Belgium. This consul devotes much space to showing that the "blooded stock" which has been imported from England and other countries only became valuable by a persistent devotion to stock-breeding with relation to dairy requirements. He insists that the same minute attention and care expended upon American cattle would yield similar results, with the expenditure of a far smaller amount of money. The book is illustrated by a great number of pictures of cattle, dairy implements and processes. It contains also many tables of statistics, largely commercial in character, which it would be difficult to find elsewhere.

III.—THE INVESTIGATIONS AND INSTRUCTIONS CARRIED ON AT AGRICULTURAL COLLEGES AND SCHOOLS AND AT AGRICULTURAL AND EXPERIMENT STATIONS.

In the United States practical investigations in dairying are carried on at thirty agricultural stations. They include the various processes of butter and cheese-making, the losses in these processes and means of eliminating them; the effect of food and of the quality of milk on the composition and yield of dairy products; tests of dairy machinery and apparatus; the utilization of the waste products of the dairy; management of creameries and the handling of milk

In 1825 the Government of France appropriated only 276,000 francs to instruction in agriculture, while at present the amount exceeds four millions. There are three great national schools of practical agriculture and one of the milk industry. The importance of the latter is increased by the very great annual production of milk in France, amounting, according to the most recent statistics, to 1,855,000,000 gallons per annum, and also by the great variety of its cheese and milk products.

The system of public instruction relating to milk is dominated by the national school, which aims to combine experimental and practical work with the largest feasible measure of scientific investigation. This school manufactures on a small scale the different kinds of cheese, butter, sterilized milk and sugar of milk It has steam power, refrigerating apparatus, workshops, lecture and museum halls and an experimental dairy. In the latter about 800 quarts of milk are made each day into butter and cheese.

The course of instruction includes the study of milk, its products, its alterations, the utilization of milk residues, defects and maladies of milk and cheese and means of curing them; also the study of the conduct of dairies, the care of dairy cattle, their feeding, etc The course lasts one year, the students paying no fees, but performing all the work of the establishment, including care and cleansing, the removal of the cream by various methods making of cheese of many kinds, butter, analyses, etc.

The number of scholars is necessarily restricted, but in addition to those attending the full courses there are others who come to acquaint themselves with special branches of the milk industry.

The great difficulty in France, however, as it is in this country and everywhere else, is to get the knowledge into the possession of the children of the farm laborers and the sons of the small farm proprietors These children at the age of twelve or fourteen years leave the common schools, where they have been taught only such elements as all children should acquire, and without further aid would never acquire the special knowledge alluded to above. To overcome this difficulty the system of agricultural instruction in France has recently been widened by the institution of a new class of farm schools. These take lads at the age when they leave the primary schools and while they still have the habitude of study, but before they are sufficiently grown to be of great service as farm hands -that is, between the ages of thirteen and seventeen—their time is divided into two equal parts Half of the day is devoted to farm work, the care of the cattle, getting ready their rations; study and care of machines, gardening, tree culture, etc. The other half is devoted to lessons, lectures, laboratory studies and experiments. The pupils are divided into two sections, each of which takes alternately practical work from the noon of one day to the noon of the following day. Whilst one section is at work the other is engaged in study, and *vice versa*.

This organization has for its object the avoidance of mental strain on the one hand and of physical fatigue on the other, since only one-half of the day is employed in outdoor work on the farm, whilst the other half is spent in school. The alternation of head and hand work develops in a remarkable manner both mental and physical energy, and the lads acquire the habitude of working both rapidly and well. During the course of the year and the change of seasons they pass successively through all the varieties of occupation connected with dairy and farm work.

France has already forty schools of this kind scattered over the various provinces, and is rapidly increasing their number. Italy has thirty-two similar schools. They are being imitated in other foreign countries and might be most advantageously introduced here. They bear, in fact, a similar relation to agriculture as the manual training schools in the cities do to manufactures and the mechanic arts.

In the United States the number of schools and colleges in which courses of instruction relative to dairying and agriculture are given is not far from seventy. They have about 1,200 instructors, and a total of not far from 12,000 students, of which a little more than one-fourth devote themselves especially to agriculture. This is a very small number considering the fact that our farmers far outnumber those engaged in all branches of mechanic arts, and considering also the very liberal appropriations made by the various States and by Congress for the support of these schools By the act of Congress of July 2, 1862, they received an endowment from the sale of public lands granted to the several States for this purpose, and by a subsequent act, August 30, 1890, grants of money from the United States Treasury were made for the maintenance and endowment of the land-grant colleges. Fifteen thousand dollars was appropriated to each institution for the year ending June 30, 1890, and the act provides for an annual increase of $1,000 in succeeding appropriations for ten years. after which the annual amount to be paid to each State or Territory is to be $25,000.

In New Jersey the Agricultural College, at New Brunswick, gives a four-year course which is mainly devoted, under the direction of Professor Vorhees, to the scientific side of the subject, and includes courses in botany, entomology, biology, etc. It also gives a short course of six weeks, which is sufficient for obtaining a practical knowledge of the methods used in creameries, and includes a few of the most important and simple chemical methods, such as determinations of specific gravity, fat, etc. These courses are similar to those given under Professor Caldwell at the college at Ithaca, N. Y., and everyone proposing to carry on dairying as a business should avail himself of the shorter course, at least. The former college also sends out lecturers to address the boards of agriculture, and has also established extension courses of twelve lectures of one hour each, weekly. After the lecture an hour is devoted to questions and answers and to explanatory addresses. Even three weeks in a model creamery, arranged for teaching purposes, has proved invaluable to many young men now in charge of creameries in New York State and New Jersey. But as they are backward in leaving their homes, Dr. Collier, the director of the New York Station (report for 1889, p. 587), advocates the establishment of a dairy school, in which there should be given instruction only in those technical branches directly relating to the science and practice of dairying, with at least ten branch sections in different parts of the state.

IV.—PROCEEDINGS OF STATE AND COUNTY BOARDS OF AGRICULTURE, ALSO OF AGRICULTURAL INSTITUTES, EXHIBITS AND FAIRS AND THE TESTS MADE IN CONNECTION THEREWITH.

These proceedings are published by the State and afford a great deal of information The exhibits and fairs, in connection with the examinations and awards of judges, if properly managed, and degrading side-shows excluded, are most valuable in diffusing knowledge of the latest appliances and discoveries. They sometimes afford opportunities of bringing out facts which would not be obtained in any other way, as in the following statement, which strikingly exhibits the effect of worry and excitement on the amount and composition of milk. The results were obtained from six cows exhibited at a fair. The analyses were made by Hills (Vermont Station, 1890, E S R., 1891, p. 515). The milk given by each cow during twenty-four hours previous to her exhibit, and for twenty-four hours afterward, was as follows:

TOTAL YIELDS OF MILK AND MILK CONSTITUENTS.

	Milk yield (pounds).	Total solids (ounces).	Fat (ounces).	Casein (ounces).	Milk sugar and ash (ounces).
No. 1, Ayrshire—					
At home, September 2, . .	26.50	61.70	19.18	18.40	24.12
At fair, September 4, .	31.00	78.21	33.10	17.23	27.88
More (—), less (—) than at fair, . .	—4.50	—16.51	—13.92	+1.17	—3.76
No. 2, Jersey—					
At home, September 2, . .	23.06	52.60	18.41	13.14	21.05
At fair, September 4, . . .	24.44	58.34	21.99	14.17	22.19
	—1.38	—5.74	—3.57	—1.03	—1.14
No 3, Jersey—					
At home, September 2, . .	28.75	60.94	19.63	14.81	26.50
At fair, September 4, . .	23.13	50.56	16.28	11.97	22.31
	+5.62	+10.38	+3,35	2.84	+4.19
No. 4, Jersey—					
At home, September 2, . .	32.75	67.66	23.41	14.10	30.16
At fair, September 4, .	33.07	62.48	19.32	14.02	29.14
	—0.32	+5.18	+4.09	+0.08	+1.02
No. 5, Ayrshire—					
At home, September 2, . .	20.31	43.37	14.07	10.13	19.17
At fair, September 4,	17.07	37.54	13.75	8.23	15.55
	+3.34	+5.83	+0.32	+1.90	+3.62
No. 6, Holstein—					
At home, September 2, .	18.94	38.01	11.95	9.03	17.03
At fair, September 4, . . .	18.63	37.31	12.19	8.75	16.37
	0.31	0.70	—0.24	0.28	0.66

The sudden increase (in the case of No. 1) from 19 2 to 33.1 ounces butter fat in twenty-four hours on removal from home to strange and disquieting surroundings was most unexpected, but fully authenticated

To summarize the results obtained, the effects of worry and confusion on the system of cows as shown in the milk-flow appear conflicting, depending upon individuality. Some cows produced more at home amid their usual surroundings, while some seemed stimulated by excitement and nervousness and made a better showing at the fair grounds than they did at home. The data at hand seemed to indicate that the tendency of nervous excitement is to lessen the quantity of milk ingredients and to variously affect quality according to the individuality of the animal, the fat being the most variable ingredient. In the light of such results it may be well to consider whether the true "butter test" of a cow should be made under the circumstances attending a great fair or at home among natural surroundings and away from unnatural excitements.

V —TRAINED DAIRYMEN AND SMALL FARMS.

The writer has personally visited a large number of dairy-farms in the northern and northwestern parts of the State, and above all things was impressed with the imperative necessity of the young men availing themselves of the instruction offered by the State, in order that the unremunerative condition of the dairy industry should be remedied. Without scarcely an exception these young men complained that their wages left them at the end of the year no margin for accumulation, and professed their desire to escape to the cities and some other employment. The also stated that the farms themselves, usually of 100 acres and upward, often earned nothing or but a few hundred dollars for their owners, and were lap-ing into debt.

Certainly, instead of the listless and discouraged lives that these discontented men are leading, they should begin by getting a special training, just as a mechanic must fit himself for his work. Instead of farms of 120 to 150 acres, which represent too much dead capital, dairy-farms of far smaller size, with the capital turned into better breeds of cattle and a proper equipment and the labor and skill concentrated within paying limits, would afford handsome returns. Such small farms would be purchasable with the savings of a young man who had begun by specially fitting himself for his business. They would not be too large to prevent him from taking the entire supervision and attending with enthusiasm to all those thousand and one details which together make business success. He could devote himself to each individual cow, and with tests determine whether its keep represented a loss or gain. He could thus raise the profits on each cow to a much higher figure than is possible in the indiscriminate handling usually practiced and could select and breed always to more and more profitable results. With his special training he could turn his dairy products into the best shape for profit, and not be compelled to sell his raw material at the prices which combinations will always force on unskilled labor.

To place the difference between unskilled dairy labor and skilled labor in the most striking light, it is enough to note that milk produced and handled by skilled labor is sold in this State at retail at ten cents a quart, while whole milk not thus handled is selling alongside of it at from four to six cents per quart. Popular opinion has become so educated by the results of milk inspection and control that it gladly upholds the payment of five cents per quart more, in order that the dairyman may apply the results of the latest scientific knowledge to the management of his dairy. It pays this five cents for the assurance that the dairyman has had his water-supply examined and that it has been pronounced pure; that the veterinarian has examined the cattle and excluded those that are diseased and tuberculous from the herd; that the biologist has seen that the milk is not injured by bacteria, and that absolute cleanliness is striven for everywhere. Such being the case, it is profitable business to look after the bacteria, and to conduct a dairy in accordance with the highest sanitary, as well as the best breeding and feeding standards. There is no practical wisdom or business common sense in sneering at the bacteria and care and knowledge, when these cares and knowledge are so handsomely paid for. There is a most pressing demand in this State for overseers and dairymen who are up to the requirements They will be well repaid and will do far better than if they abandon the dairy to swell the ranks of labor in the cities

VI.—CONDITIONS AFFECTING THE QUANTITY, QUALITY AND COMPOSITION OF MILK.

These conditions are:

1. Breed.
2. Individual characteristics.
3 Period of lactation, or time since calving.

4. Time of milking—night or morning.
5. Frequency of milking.
6. The portions of a milking, the first drawn or strippings.
7. Conditions and care as to comfort, cleanliness, housing, exercise and wamth of the cattle in the field and stable.
8. Water-supply.
9. Disease. Disorders preceding or consequent upon calving.
10. Manner of milking and handling milk in the stable.
11. Cooling and handling of milk in the dairy and creamery.
12. Methods of bottling, transport and delivery.
13. Feed and fodder.

Apart from sanitary conditions and the precautions which should surround the production and use of milk as the most important and the most easily affected of infant foods, the chief conditions to be studied are the Breed and Feed. The factors seven to twelve are those which have received of late the greatest share of attention by the general public and by the medical profession, and have called for radical changes and improvements in the methods of conducting the business of dairying.

1. Breed.

According to the Maine S. R. 1889 (E. S. R, 1891, p. 648),* the Holstein cow consumes the largest amount of food in the year and produces the largest gross amount of milk, milk solids, skim-milk and buttermilk, and the second largest gross amount of butter, being exceeded in this last respect by the Jersey.

The Michigan Station (E. S. R., 1891, p. 359) made the following test of the milk-producing qualities of different breeds:

The plan required the use of two young cows from each of the four representative breeds, of the same age, and whose pedigree and method of feeding were well known; the cows during time of experiment to be fed according to a definite plan, and a record kept of the kind and the quantity of food consumed; a daily record of the amount of milk given by each cow; a careful chemical analysis of the milk from each cow two or three times a week; churning the milk from each cow two or three times a week to determine the churnability of the milk to estimate the amount and quality of the butter made; the analysis of this butter and of the buttermilk to determine the completeness with which churning will separate the milk fats by comparison with the fats found in the whole milk, thus affording the data for determining the relative value of representative breeds for the dairy and cheese factory.

---

*The abbreviation E S. R. means Experiment Station Report, and many of the results stated in this article are from the summaries of large numbers of experiments as set forth in these reports.

It seemed to these departments that such an investigation carried through an entire season, with two cows of each breed to "eliminate the personal equation," when the history of the cows was known and their food made a matter of record, would afford a basis for a safe estimate of the relative value of these breeds as milk producers. Only three pairs of cows furnished milk for this investigation, and these did not come to milk at the same time.

The plan proposed was only partially carried out, and the experiment was discontinued August 22. The method of gathering samples of milk for analysis and the method of analysis are described. The results of analyses of milk made at different dates, from April 16 to August 22, are stated in detail and summarized in tables. The average composition of the milk of the two cows is given as follows:

	Jerseys. Per cent.	Aryshires. Per cent.	Holsteins. Per cent.
Total solids,	13.85	12.04	11.22
Butter fat,	5.51	3.68	3.33
Solids not fat,	8.53	8.35	7.89
Water,	86.15	87.96	88.78

A Michigan law declares that milk containing "less than 12½ per cent. of solids, or less than 3 per cent. of fat, shall be deemed adulterated." Both the Aryshire and Holstein milk fell below the required standard as regards amount of total solids, though above the standard as far as fat is concerned.

According to the New York State report for 1891, the Holstein breed of cattle gives the largest daily yield of milk, amounting in the comparisons quoted, and which extended over one period of lactation in each case, to 22.65 pounds. The Aryshire yielded the next largest, 18.4 pounds; then the Guernsey, 16 pounds; the Jersey, 14.07; the American Holderness, 13.4, and least, the Devon, with 12.65 pounds.

While greatest in quantity of milk, the Holstein milk contains the least total solids, 12.39 per cent., and the least fat, 3.46 per cent. While smallest in quantity, the Devon milk does not contain the greatest total solids (in trial, 13.77 per cent.), nor the highest fat (in the trial, 4.15 per cent.). But the breed yielding an intermediate quantity of milk, which is the Jersey, at the same time exhibited the greatest solids (15.4 per cent.) and the highest fat (5.61 per cent.).

It is evident, therefore, that in order to supply milk which shall maintain even so moderate an average of total solids as 13 per cent., the dairy could not be run with Holsteins alone.

The breeds present striking differences as to the size and number of the fat globules. As these differences have important practical bearings, they are presented here in the following table, likewise supplied to us in the above New York report:

SIZE AND NUMBER OF FAT GLOBULES IN MILK OF CATTLE OF DIFFERENT BREEDS.

BREED.	GLOBULES OVER $\frac{1}{3500}$ IN. IN DIAMETER.	SMALL GLOBULES.	LARGE GLOBULES.
Holstein –	11.3 % of total and 11.3 % of total fat.	Large number.	Small number.
Ayrshire—	24 % of total and 21.1 % of total fat.	Large number.	Small number.
Devon—	35 % of total and 34.4 % of total fat.		
Guernsey –	55 % of total and 55.4 % of total fat.	Smaller number.	Larger number.
Jersey—	70 % of total and 62.5 % of total fat.	Small number.	Large number.

Inasmuch as the large globules are those which first rise to the surface, the above differences also explain the different behavior of these milks in butter and cheese making.

As to butter making, a valuable comparison has been made by Van Slyke (N. Y. State Rep. 1891, and E. S. R IV., p. 268).

The trial extended over one period of lactation (ten months). The fat was most perfectly recovered from the Guernsey milk, the Jersey closely following The Jerseys gave most butter per 100 pounds of milk. The Holsteins averaged the most milk a day, but the Guernseys, closely followed by the Jerseys, the most butter. The Guernsey cream churned quickest, the Holstein slowest. The cost of food was about twice as great during the tenth as during the first month of lactation; the average per pound of butter for the entire ten months being 14 07 to 16.07 cents with the Guernseys and Jerseys, and from 22.04 to 22.03 with the other breeds.

Allowing twenty-five cents per pound for butter, and making no allowance for the manurial value of the food or for the value of the skim-milk and buttermilk. the profits calculated to one cow of each breed for the ten months were:

Guernseys, $27.60; Jerseys, $22.15; Holsteins, $5.75; Holdernesses, $4.65; Devons, $4.30; Ayrshires, $3.70.

The fat lost and recovered from one hundred pounds of milk in butter making was as follows:

BREED.	FAT IN FRESH MILK.	FAT RECOVERED IN BUTTER.	FAT LOST IN—	
			SKIM MILK.	BUTTER-MILK.
	Pounds.	*Pounds*	*Pounds.*	*Pounds.*
Jersey, ...	5.68	5.06	0.37	0.06
Guernsey, ...	5.02	4.57	0.32	0.03
Devon, ...	4.46	3.67	0.57	0.03
Holstein, ...	3.74	2.79	0.68	0.12
Holderness, ...	3.60	3.01	0.44	0.05
Aryshire, ...	3.50	2.77	0.55	0.09

It will be noted that the Jersey milk contained the most fat, and it also yielded most butter per hundred pounds of milk. From what has been stated in another place with regard to the relative number of the large and small fat globules and the percentage of the total fat contained in each, it might be expected that for equal weights of fat the relative butter-making efficiency would have been: Jersey, first, then Guernsey, Devon, Aryshire and Holstein. But in the above trials the amount of butter made from one pound of fat in the milk was:

	Pounds.
Guernseys,	1.07
Jerseys,	1.04
Devons,	0.97
Aryshires,	0.93
Holsteins,	0.88

It required less milk to make one pound of butter with the Jerseys than with the other breeds. If 100 pounds of Jersey milk makes a certain amount of butter, the milk of each breed required to make the same amount is:

	Pounds.
Jerseys,	100.0
Guernseys,	111.3
Devons,	140.0
Holdernesses,	170.8
Ayrshires,	183.3
Holsteins,	183.9

Average daily yield of milk and butter during ten months of lactation:

Breed	Milk.	Butter.
Jersey,	14.9	0.89
Guernsey,	16.6	0.90
Devon,	12 0	0.01
Ayrshire,	18.6	0.61
Holstein,	24.3	0.79

With regard to the influence of advancing lactation upon the production of butter, the results arrived at by Van Slyke pointed to the following conclusions:

1. In most cases the per cent. of fat is greatest during the first month of lactation.

2. In the second month of lactation the per cent. of fat drops considerably in most cases, the diminution being greatest in the richest milks.

3. The general tendency is toward a greater loss of fat in the skim-milk as lactation advances

4. The largest milk-yield, with most breeds, is in the second or third month, after which there is a gradual but not uniform diminution.

5. The general tendency is toward an increase in both the temperature and the length of time required for churning as the period of lactation advances.

In regard to cheese-making, as the result of trial extending over one period of lactation, Van Slyke arrived at these results :

RELATIVE VALUE OF MILK IN CHEESE MAKING.

BREED.	AVERAGE COMPOSITION OF MILK.			Milk required to make 1 lb of cheese.	Average yield of cheese per month.	Cost of food per lb. of cheese.
	Fat.	Casein and albumen.	Ratio of fat to casein and albumen.			
	Per cent.	*Per cent.*		*Pounds.*	*Pounds*	*Cents.*
Jersey, ...	5.68	3.76	1 : 1.50	8.00	56.14	7.95
Guernsey, ...	5.02	3.60	1 : 1.40	8.40	59.60	6.61
Devon, ...	4.46	3.81	1 : 1.17	8.64	41.32	8.20
Holstein, ...	3.74	3.23	1 : 1.16	9.48	78.46	6.95
Holderness, . . .	3.60	3.19	1 : 1.13	9.72	46.28	7.48
Ayrshire, . .	3.50	3.34	1 : 1.05	9.68	59.77	7.24

This table indicates (with one exception) that the yield of cheese corresponds more closely to the fat percentage than to the casein and albumen, or that the fat exercises a greater influence on the yield of cheese than the other constituents do.

In this State experiments were made with different breeds for the period extending from May 1, 1889, to October 31, 1890, and the following summary of the valuable results obtained from these experiments, which were carried on at the New Jersey Station, is given in the Station report for 1891.

The amount and proportion of the food compounds furnished the herds in the daily rations since December, 1889, remained practically constant. The green food and pasture during the summer months were fed in such quantities as to substitute the coarse materials fed during the remainder of the year.

The total solids in the milk of all the breeds was lowest during the summer months; a gradual decrease in quality was noticed from April to June, and an increase from September, though the actual food compounds eaten were as uniform as possible, and the period of greatest milk flow did not occur for all the animals during the months from June to September, inclusive. It would seem, therefore, that summer conditions of food and weather, which as a rule favorably influenced milk flow, did so at the expense of quality.

The analyses show also that in the month of June there was a decided change in the relative amounts of the casein and sugar in the milk of all breeds, viz., a decrease in the per cent. of casein and an increase in the sugar.

The cost of food consumed was secured from the prices actually paid for the concentrated feeding stuffs, and by fixing market values on produce raised on the farm, and is uniform throughout for all breeds The prices used were as follows: Hay, $10 per ton; wheat bran, $17.60; corn and oat meal, $20.40; cotton-seed meal, $25.40; linseed meal, $29.40; gluten meal, $22.50; oil meal, $25; dried brewers' grains, $16.60; cornstalks, $6; green fodder, $2.50; silage corn, $3.50; roots, $8 per ton; and pasture, 10 cents per day of 12 hours.

The average yield of milk per day indicates that on the basis of milk production the five breeds represent three classes, the Guernseys and the Jerseys going together, with an average of 8.5 quarts; the

Ayrshires and Shorthorns, with an average of 9 quarts; and the Holsteins, a class by themselves, with an average daily yield of 11 quarts, 23 per cent. greater than the first, and 18 per cent. greater than the second.

The average cost of the daily rations also varies considerably, and in such manner as to make the average cost of food per quart of milk very uniform, the lowest, 1.66 cents, being for the Ayrshires, and the difference between the highest and the lowest cost but one-quarter of a cent. It should be said, however, that in the case of the Holsteins, the cost of the ration was considerably increased by the fact that the amount of coarse fodder eaten by them was greater than in the other breeds and consisted largely of timothy hay, one of the most expensive foods eaten, which probably did not materially aid in milk production.

The breed giving the lowest average per cent. of total solids in the the milk (Holstein-Friesians) produces the greatest amount of milk per day, and that in this breed it is produced in such quantity as to yield the greatest amount of total solids daily.

According to the results obtained at the N. H. Station (see Whitcher, E. S. R., 1891, p. 65), the fat of the Jersey milk ranged from 3.34 to 6 06 per cent., average 5 12 per cent; of Ayrshire, from 3.81 to 4.55, average 4.28; Holstein, from 2.84 to 3.54, average 3.13; Shorthorn, from 3.50 to 4.15, average 3 86 The cows had been fed practically alike. Analyses are cited in support of the statement that "the average differences in the fat percentage of their milk are due to the breed, not to the feed" That one of the Jerseys would make a pound of butter from fifteen pounds of milk, while another would yield only a pound of butter for twenty-one pounds of milk, and this on the same kind of food, is one of the numerous illustrations cited of what is urged as a general principle, that "breed and individual characteristics are the two great factors that determine the richness of milk"

The milk of six breeds during one period of lactation was analyzed at the N. Y. Station during the year 1891, with the following average results:

AVERAGE COMPOSITION OF MILK OF SIX BREEDS

BREED.	Total Solids.	Solids, Non-fat.	Fat.	Casein.	Milk, Sugar.	Ash.	Daily Yield.
	Per Ct.	*Per Ct.*	*Per Ct.*	*Per Ct.*	*Per Ct.*	*Per Ct.*	*Lbs.*
Holstein, . . .	12.39	9.07	3.46	3.39	4.84	0.735	22.65
Ayrshire, .	13.06	9.35	3.57	3.43	5.33	0.698	18.40
Jersey, . .	15.40	9.80	5.61	3.91	5.15	0.743	14.07
Holderness,	12.63	9.08	3.55	3.39	5.01	0.698	13.40
Guernsey, .	14.60	9.47	5.12	3.61	5.11	0.753	16.00
Devon, .	13.77	9.60	4.15	3.76	5.07	0.760	12.65
Average, .	13.64	9.40	4.24	3.58	5.09	0.731	16.20

The ash varies least, sugar next, then casein, and most of all, the *fat*. Hence the fat gives the best measure of the value of the milk, both for butter and for cheese making.

The Holsteins give the lowest solids, then the Holderness, Ayrshire, Devon, Guernsey, and highest, the Jerseys. The order for fat is Holsteins, the lowest, then Holderness, Ayrshire, Devon, Guernsey and Jerseys. But in total production of milk, the Holsteins lead, with a daily yield of 22.65 pounds, Ayrshire next, then Guernsey, Jersey, Holderness, and the Devons the lowest, with 12.65 pounds.

In the course of inspection the question of breed frequently comes up and demands the most serious consideration. In the month of April of this year the milk of one of the largest and best-appointed dairies in this State was condemned by the inspectors in the city of New York, to which place it is exclusively shipped, and the dealers fined. The dairyman thought some serious blunder must have been committed, or that he had been grievously wronged. He had two samples, representing the whole milk of his dairy, analyzed by responsible chemists in New York. They reported that the milk was certainly much below standard, having the composition :

	I.	II.
Fat, ...	3.30 per cent.	3.60 per cent
Casein, Albumen, Milk-sugar,	7.07 per cent.	7.30 per cent.
Ash, ...	0.66 per cent.	0.66 per cent
Total solids,	11.03 per cent.	11.56 per cent.

Still more astonished at these results, the proprietor of the dairy brought to me two more samples, representing as nearly as possible similar milk to that examined in New York, with the request that I should check the New York results by independent analyses. The samples yielded the following results:

	I.	II.
Fat, ...	3.46 per cent	3.37 per cent.
Albumenoids, .	3 01 per cent.	3.02 per cent.
Milk-sugar, .	4.65 per cent	4.48 per cent.
Ash, . . .	0 68 per cent.	0 64 per cent.
Total solids, .	11.80 per cent.	11.51 per cent
Specific Gravity at 15° C., . . .	1.0304 per cent.	1.0296 per cent

In order to satisfy myself by personal inspection, I visited this dairy, where every detail of feeding, care and the history and condition of the cattle was explained in full. I found the water excellent, and so also the arrangements for cooling and handling the milk. The cows were in admirable condition, and their stabling and keeping as they should be They were mainly thoroughbred registered Holsteins. The analyses above reported are of milk which was stated to be the whole mixed milk of six of these thoroughbred Holsteins in an average condition as to freshness. Their feeding was as follows, April, 1894:

5 A. M.—Hay.
6 A. M.—4 quarts mixed feed; milking.
7:30 A. M.—Hay.
9 A. M.—Turned into field till—
4:30 P. M.—Cornstalks and hay.
5 P. M.—4 quarts feed; milking.
6 P. M.—Hay.

The feed was made up of four tons of ground yellow shelled corn, two tons of middlings and two tons of bran. I examined samples of these separate materials in the laboratory and found them to be of good quality.

In order to arrive at the nature and extent of the variations in the quantity and composition of these thoroughbred Holstein cattle under the same conditions of feed and keep, but under different conditions as to freshness, I had the total milk of a Holstein, due in the course of about nine weeks, drawn into one pail, and the total milk of another Holstein, which had calved a month previously, drawn into another. The first yielded only one and a half quarts. It was stated to be giving about two and a half quarts at the morning milking, or a total of four quarts per diem, and at the time of my visit was the lightest milker in the herd.

The composition of this one and a half quarts of night's milk was:

SMALLEST MILKER.

	Per Cent.
Fat,	5.00
Albuminoids,	3.48
Milk sugar,	4.23
Ash,	0.71
	13.42

The heaviest milker, the one which had recently calved, yielded nine quarts in the evening, of which a portion was taken and analyzed as below, and eleven quarts in the morning, or twenty quarts in all.

LARGEST MILKER.

Fat,	2.80 per cent.
Albuminoids,	2.70 per cent.
Milk-sugar,	4.16 per cent.
Ash,	0.58 per cent.
	10.24 per cent.

Taking 12 per cent. as the standard for total solids and 3½ per cent. for fat, there were then in the same herd, fed on the same rations, at one extreme a cow whose milk exceeded the standards of solids and fat by 1.42 per cent. and 1.50 per cent., and at the other extreme, a cow whose milk fell below these standards by 1.76 per cent. and 0.70 per cent.

On obtaining these results, the gentleman owning the dairy changed the make-up of the herd, by the addition of a sufficient number of Jersey cattle to insure the percentage of total solids and fat always going above the State requirements.

Striking confirmation of the above statements is found in the results of the examination of the milk of the registered cattle at the great thousand-acre Del Marvia Farms Dairy, at Belle Mead, N. J.

Many of the celebrated cattle at this dairy were obtained originally by Senator McPherson in Holland, and imported by him in charge of the Frisian who had reared them. These cattle, and still finer strains, resulting from many years of selection and breeding with registered Jerseys, make up the present stock.

On the 15th of May, one of these registered Holsteins, milking since March 1st, seven years old, weighing 1,550 pounds, and yielding eighty pounds of milk per diem, gave a sample of gravity 1.0298 with 11.62 per cent. of total solids and 3.6 per cent. of fat.

On the same day, a registered Holstein heifer, three years old, weighing 1,150 pounds, and milking since December 1st, 1893, with yield at date of sixty pounds per diem, gave milk of gravity 1.034 with 13.01 per cent. of solids and 3.6 per cent. of fat.

The herd milk of all the registered Holsteins had a gravity of 1.0325 with 12.7 per cent. of total solids and 3.6 per cent. of fat.

On the same day one of the registered Jerseys, four years old, weighing 975 pounds, and milking since March 1st, yielded a sample of 1.0324 gravity, with 15.5 per cent. solids and 6 per cent. fat.

Another registered Jersey, four years old, milking since November 3d, 1893, and weighing 675 pounds, gave milk of gravity 1.0323 with 15.2 per cent. solids and 5.8 per cent. fat.

The herd milk of all the registered Jerseys had a gravity of 1 0325 with 14.8 per cent. of total solids and 5.4 per cent. of fat.

In order to verify these results by personal inspection, I visited the dairy October 19th. The barns I found to be very large, well ventilated, recently whitewashed on the interior, with abundance of light, and the cattle supplied with pure water by automatic reservoirs, and kept clean with fresh bedding. At the time of my visit, I took a sample from the mixed milk of twenty Holsteins, and also a sample from the mixed milk of sixty-five Jerseys. I had intended to make a careful detailed analysis of each, but arriving home late at night I placed the samples in the refrigerator at my house, where the cook found them in the morning and drank the rich sample—the Jersey milk. The other, the Holstein, had a gravity of 1.031 with 12.01 per cent. of solids and 3.3 per cent. of fat.

The ration at that time was ten pounds of one-third oats, one-third corn and the balance linseed meal and bran, fed twice a day with hay. The thirty-one Holsteins which were milking gave seventy pounds per diem for the heaviest milker, and twenty-five pounds for the lightest. These large figures are as reported to me by the overseer.

The creamery attached to this dairy was in charge of a young man who had prepared himself for the work by a three weeks' course in the model creamery of the agricultural school at Ithaca, N. Y. He had a system of accounts by which the quantity and values of the milk coming in and the products going out were recorded. He determined the weights, gravities and costs of the milk; attended to the cooling and aeration; the sterilizing of the bottles and the bottling; the determination of the percentages of the fat by means of a Babcock test, run by steam; the fat separator, churning machines; the butter machine, and ran the furnace, boiler and all the machinery.

Another illustration may be taken from the herd of thirty registered cattle, twenty-six of which are Jerseys and four are Guernseys (July 23d), belonging to the dairy of Mr. Malcolm Thompson, of Bernardsville, Somerset county. The inspector reported the condition of the cattle as excellent; the stables large, roomy, well ventilated, with ample windows and air-shafts, and with complete drainage. The stable floors are of plank, scrubbed weekly. Lime, as a deodorizer, is freely used. The manure is removed daily to some distance from the stable The milk-house is a stone building located 200 feet from the stables, with a cement floor, scrubbed daily. The water is supplied by mountain springs, and is pure, cold and abundant.

Samples I and II, were taken from individual cows, and III, represented the milk of the entire herd.

MILK OF JERSEY COWS.

	I.	II.	III.
Total solids, . .	14.26 per cent.	13.4 per cent.	13.73 per cent.
Fat, ...	5.23 per cent.	. . . . . .	4.83 per cent.
Ash, ...	0.74 per cent.	0.69 per cent.	0.73 per cent.

A report of the inspection of Mr. William C. Hendrickson's herd and stables at Belle Mead, made July 16th, is equally favorable. Especial emphasis is placed on the solid flooring of the stables and their cleanly condition; on the removal of the manure to a distance, and on the good drainage; on the aeration and cooling of the milk, which is done in a brick building at a distance from the stables As a further precaution, at this season, ice is placed on the cans kept over night.

There were sixty-three head of registered Jerseys, producing about 375 quarts of milk per diem. The analyses are of the samples as received. I and II, as coming from individual cows, and III, as the herd milk. From the figures, I should suppose that sample I represented only a part of the milking.

MILK OF JERSEY COWS.

	I.	II.	III.
Total solids, . .	17.00 per cent.	13.50 per cent.	13.40 per cent.
Fat, ...	8.25 per cent.	4.60 per cent.	4.60 per cent.
Specific gravity,	1.0261 per cent.	1.0317 per cent.	1.0312 per cent.

I quote in extenso a short report of Charles Scudder's Dairy, Ewing township, Mercer county, N. J.:

"This dairy contains thirty head of 'Jersey' cattle, milking about 150 quarts per day. The stable is well ventilated and roomy, and the cattle are well cared for, and apparently perfectly healthy. They are fed ground corn mixed with glucose; each cow about twelve quarts per day, with a ration of good fresh hay. The milk is cooled by means of the Star Aerator immediately after milking. Milk-house for bottling the milk is situated about 300 feet from the stable; it has cemented floor, and is kept scrupulously clean. The bottles are cleaned with a patent steam brush in scalding water, the utensils are also well scalded and kept clean and bright. All his arrangements for cleaning and caring for the milk vessels are admirable His barn is situated on a hill, and has excellent drainage; no waste or offal is allowed to remain in or about the stables, it being removed twice a day." [February 20th, 1894. Inspector, R. S. Dowling.]

A sample of this "Jersey" milk, taken on the same day, had a yellowish color, a sweet, pleasant taste and aroma, and a gravity of 1.034. It contained—

Fat,	5.37 per cent.
Albuminoids,	3.41 per cent.
Milk-sugar,	4.63 per cent.
Ash,	0.59 per cent.
Total solids,	14.00 per cent.

Also a report upon the dairy of William B. Lippincott, Hartford Burlington county, February 19th, 1894, by Inspector P. L. Vandegrift:

There are twenty-nine head of registered Jersey cows in this stable. The barn is situated on elevated ground, is well drained, lighted and ventilated, and no waste or manure is allowed to remain in the stable. The water is furnished to the cattle in troughs in the stable from a well forty feet deep, which is situate on a hill outside of the barn-yard. Each cow receives four quarts of ground corn and cob meal, one quart of cotton-seed meal, one-half bushel of brewers' grains, plenty of clover hay and corn stalks. The animals are all in a very fine and healthy-looking condition. At present there are twenty-four cows giving milk. The product per day is about 160 quarts. The milk is removed from the stable as soon as it is drawn from the cow, and properly cooled and aerated. The milk utensils are kept clean and bright, and all the surroundings of this dairy have the air of a well-kept place. The stock have plenty of exercise on clear days, but when the weather is unfit they are kept in the stable.

The milk is sold at wholesale in Philadelphia at five cents per quart all the year.

A sample taken from the entire milking contained--

“JERSEY” HERD MILK.

Fat,	4.91 per cent.
Albuminoids,	3.90 per cent.
Milk-sugar,	4.57 per cent.
Ash,	0.77 per cent.
Total solids,	14.15 per cent.
Specific gravity,	1.0335 per cent.

Without any intention of comparing the performance of graded with that of registered cattle, upon the evidence of a limited number of analyses, it will be of interest to quote here the results of the inspection and analysis of the dairy milk of Edmund Cook, Burlington county, N. J., February 27th. The herd consisted of fifty head of graded cattle; the yield, about 200 quarts per diem. The cattle were all raised on the farm, which contains 212 acres. They were all in healthy condition, and were fed a ration of three pecks of ensilage, four quarts of corn meal and cotton-seed meal and bran mixed, with all the clover hay they required. The stabling, cooling, aerating and handling the milk, the water-supply, etc., were excellent.

HERD MILK OF FIFTY GRADED COWS.

Fat,	5.10 per cent.
Albuminoids,	3.28 per cent.
Milk-sugar,	4.73 per cent.
Ash,	0.77 per cent.
Solids,	13.88 per cent.
Gravity,	1 03 per cent.

At about the same date, February 22d, I received a sample from the dairy of H. F. Hamilton, Hamilton Square, Mercer county, with the following report of inspection. The results are anomalous if the sample represents the whole milking of a herd, but I give the figures as obtained.

This herd consists of nineteen head of registered Jersey cattle, eight of which are now milking. The product at present is eighty quarts of milk per day. The barn is well situated, with all the modern conveniences of a well-kept dairy, well lighted and ventilated. The cattle are fed on ground corn meal, oats, cake meal and wheat bran, and a liberal quantity of roots, and are given all the hay they can eat. They are fed five quarts at a meal. This herd is in a perfectly healthy physical condition. The milk is cooled in a cooling creamer. The milk vessels are bright and clean. When the weather is favorable, the stock are allowed exercise; in bad weather, they are kept in the stable.

WHOLE (?) MILK OF REGISTERED JERSEY HERD.

Fat,	7.08 per cent.
Albuminoids,	4.36 per cent.
Milk-sugar,	5.01 per cent.
Ash,	0.69 per cent.
Solids,	17.14 per cent.
Gravity,	1.032 per cent.

The sample had a yellow color, and a rich, very sweet and creamy taste.

The following is condensed from a report of the inspection of the Green Hill Stock Farm, near Burlington, February 28th.

This dairy contains sixteen head of registered Jersey cattle, milking about sixty quarts per day. The cattle have the appearance of being healthy and well kept. The barn is elevated and has good drainage, and is a most convenient building for dairy purposes. The cattle are groomed every day, and are also exercised every day when it is clear. The feed consists of bran and corn meal, clover hay, ensilage and corn stalks; each cow is allowed eight quarts of bran and meal, one bushel of ensilage, and all the hay and corn fodder they can eat. The well from which they are watered is located 500 yards from the barn. The water is pumped to a tank, and the cattle are watered in the stable by means of pipes running from the tank to a water-trough in front of the cows; also water supplied in the barnyard from same source. The milk is cooled and aerated in a milk-house outside of the barn.

HERD MILK OF REGISTERED JERSEYS.

Fat,	5.69 per cent.
Albuminoids,	4.01 per cent.
Milk-sugar,	5.28 per cent.
Ash,	0.79 per cent.
	15.77 per cent.

The following is a summary of inspection of the herd of Henry C. Borden, Englewood, Bergen county, March 8th:

This herd is composed of thirty-two head of thoroughbred Jersey cows, not registered. At present they are producing about 200 quarts of milk per day, which is sold in Englewood at retail at ten cents per quart.

The sanitary conditions of the place are excellent. The drainage is good, with water-supply obtained from a spring about 500 feet from the barn. The milk, after being drawn from the cows, is taken to the milk-house, some distance from the barn, and there cooled and prepared for market. This milk-house is built of hard wood, finished and decorated, with marble floor, hot and cold water, stationary tubs and coolers.

The stable is a very expensive one, and has all modern improvements, with plenty of floor space for each cow, and excellent ventilation. The cows are apparently healthy and in splendid condition. They are fed on corn meal and ground oats, about twelve quarts a day to each cow, with an abundance of clover hay. The manure is removed from the stable twice a day and spread upon the ground.

HERD MILK OF THOROUGHBRED JERSEYS.

Fat,	5 77 per cent.
Albuminoids,	4.01 per cent.
Milk-sugar,	4.56 per cent.
Ash,	0.74 per cent.
Solids,	15.09 per cent.

Illustrations might be drawn from many similar reports, but for lack of space I am compelled to omit them, and shall introduce the results obtained at dairies where domestic or graded cattle, or those of differerent breeds were kept.

The inspector, for example, reported that on March 21st, at the farm of C. F. Moore, Pilesgrove township, Salem county, there were twenty-four head of domestic cattle, of which fourteen were milking and producing 140 quarts per diem. They were fed six quarts twice a day of corn-cob meal, bran, glucose and cotton-seed meal, with stalks and hay. The milk was sold in Philadelphia at three and one-quarter cents per quart. It contained:

Fat,	4.70 per cent.
Albuminoids,	2.56 per cent.
Milk-sugar,	4.86 per cent.
Ash,	0.56 per cent.
	12.68 per cent.

At the neighboring farm of E. L. Moore, at the same date, there were twenty-six head of cattle, including four registered Holsteins and a number of thoroughbreds not registered, with the remainder of domestic cattle. They were producing 240 quarts per diem on feed similar to the foregoing, the product selling at same price. It contained:

Fat,	4.34 per cent.
Albuminoids,	3.32 per cent.
Milk-sugar,	4 64 per cent.
Ash,	0.63 per cent.
Solids,	12.93 per cent.

At the Cream Valley Farm, in the same township, March 21st, there was a herd of thirty-four head, of which nineteen were milking, consisting of eleven Jerseys, ten Durhams, six common and seven graded cows. They were fed on ensilage, corn-cob meal, bran, cotton seed meal, dried brewers grains and glucose, stalks and hay. Of the ground feed six quarts twice a day were given. The milk was retailing at six cents per quart. It contained:

Fat,	3.70 per cent.
Albuminoids,	3.28 per cent.
Milk-sugar,	4.66 per cent.
Ash,	0.62 per cent.
Solids,	12.26 per cent.

At the farm of W. M. Cole, in same township, at same date, there were eighteen head of domestic cattle, twelve of which were milking and producing 130 quarts per diem. They were reported to be fine, large cattle in excellent condition. They were getting six to seven quarts, twice a day, of corn-cob meal, bran and cotton-seed meal, along with stalks and hay. The milk was being sold at wholesale in Philadelphia at three and one-quarter cents. It contained—

WHOLE MILK OF TWELVE DOMESTIC CATTLE.

Fat,	4.69 per cent.
Albuminoids,	3.43 per cent.
Milk-sugar,	4.76 per cent.
Ash,	0.74 per cent.
Solids,	13.62 per cent.

A similar report was made as to the neighboring dairy of M. Cooper Cole, where the herd consisted of forty head of mixed stock, Holsteins, Alderneys and common, and producing 240 quarts per diem. The milk contained—

Fat,	4.08 per cent.
Albuminoids,	3.36 per cent.
Milk-sugar,	4.54 per cent.
Ash,	0.87 per cent.
Solids,	12.85 per cent

From the same locality, at the same date, there was a sample sent along with the mere statement that it was obtained from a fine herd of forty registered Holsteins. Its analysis presents some striking differences as compared with the foregoing.

HERD MILK OF FORTY REGISTERED HOLSTEINS.

Fat,	3.70 per cent.
Albuminoids,	3.28 per cent.
Milk-sugar,	4.66 per cent.
Ash,	0.62 per cent.
Solids,	12.26 per cent.

This result may be compared with the quite different one obtained from the milk of prize cows competing at the Chicago Dairy Show in 1889. They gave [Ill. Sta. R., E. S. R. 1891, 202] for the average of three Holsteins, 3.17 per cent. of fat; of two Ayrshires, 4.04; and of three Jerseys, 5.26 per cent. The first prize was awarded to a Holstein, giving in one day 65 lbs. 7 ozs. of milk, containing 3.45 per cent of fat.

The author is earnestly desirous that nothing stated in this article should be construed as indicating a belief in the inferiority of Holsteins as milch cattle. On the contrary, they are invaluable. The milk obtained by mixing the product from Holsteins with that of breeds giving richer milk, he believes to be better adapted to keep and transport in good condition; to obtain a fair compensation from, and better for the general uses of milk (including that of feeding children), than the richer milk obtained from Jersey cattle alone. The drawback that its larger volume is accompanied by a low percentage of solids, is in practice readily overcome by mixing. This also is the right way of solving the commercial and legal aspects of the matter.

3. Period of Lactation.

As illustrations of the influence of the period of lactation on the quality of milk, it is stated that the milk of one cow contained 3.5 per cent. of fat in November and December, 1888, and 3.9 per cent.

in May, 1889, on the same food; and on pasture feed 4.16 per cent. in August, and 4.23 per cent. in September; while the milk of another cow averaged 3.6 per cent. in November and December, 1888, 3.9 per cent. in April, 1889, and 4 4 per cent. in May. (See G. H. Whitcher, in N. H. Report, 1890.)

4. Morning and Evening Milk.

According to the same authority, in the case of three cows, whose milk was analyzed night and morning daily for a full year, "the morning's milk was richer than the night's milk during the time that the cows were on pasture feed, but when the same cows were put in the barn the reverse was true, that is, the night's milk was the richer."

Analyses of a large number of samples at the New York Station (R. 1890, p. 14), showed very little difference, although the night's milk contained on an average slightly more water. The quantity of milk secreted per hour was practically the same during day and night, but the amount of fat secreted averaged 11½ per cent. more during the day than during the night. (See U. S. Agr. Bull. No. 15.)

The New Hampshire Station (B. 9.) found that while cows were at pasture the morning's milk was richest in fat, but when they were kept in the barn the night's milk was richest. Thus, the average percentage of fat in the milk of one Jersey cow during June, July and August was, morning's milk 6.26, night's milk 5.75; and during January, February and March, morning's milk 5.81, night's milk 6.30. "Other cows gave corresponding results."

The Main Station (R. 1887, p. 117,) found as the average of two years that in winter the morning's and night's milk of Jerseys differed but little, but that with Ayrshires the morning's milk was better than the night's by a small constant difference. "The mixed milk of common cows during June and July contained 0.51 per cent. more solids and 0.60 per cent. more fat in the morning than at night."

At the Mississippi Station (B. 13) it was found that when cows were milked at between 5.30 and 7 in the morning and between 3.30 and 5 in the afternoon, it required on an average 18.1 pounds of the morning's milk and only 13.5 pounds of the night's milk to make a pound of butter.

5. *Frequency of Milking.*

The effect during a very short time of very frequent milking was observed with two cows, which were milked every hour—one, a Shorthorn, for twenty-four hours; the other, a Jersey, for seventy-two hours. (N H. Report, 1890).

"At the time of the commencement of the experiment the Shorthorn cow was giving 14.25 pounds of milk daily, in which there was 3.89 per cent. of fat, or 0.554 pounds of actual fat daily. In twenty-four hours of hourly milking she produced 16.25 pounds of milk, in which was 5.27 per cent. of fat, or of total fat 0.856 pounds; an increase of 54.5 per cent. in the total fat in twenty-four hours.

"The Jersey produced previous to the experiment, 10.07 pounds, in which was 6.02 per cent. of fat, or 0.606 pounds. The test was for seventy-two hours, and I will divide it into three daily periods:

	Amount of milk.	Fat.	Absolute fat per day.	Gain of total fat.
	Pounds.	Per cent.	Pounds.	Per cent.
First day,	10.5	7.05	0.743	22.75
Second day,	10.6	5.94	0.630	4.00
Third day,	10.9	5.74	0.626	3.33
Total,	32.0	18 73	1.999	
Average,	10.6	6 24	0.666	10.00

It is noticeable that in the case in which the experiment was continued three days the gain in the percentage of fat was confined to the first day, and that the gain in total fat was largest the first day, and very little the second and third days.

6. *Variation in Composition.*

The milk from the first portion of any single milking is relatively poor and increases in richness to the strippings, which are relatively very rich. Thus the New York State Station found that in the case of five cows the first pint of milk contained only 0 3 per cent of fat, while the last pint contained 6 85 per cent , and the mixed milk from the whole milking averaged 2.55 per cent In every instance the first half contained only from one-third to one-half as much fat as the last half. [See Handbook of Experiment Station Work.]

The milk of the same cow differs both in composition and in yield from day to day. Babcock states that the yield may vary by 15 per cent. and the amount of fat by as much as 50 per cent. Four cows tested at the Wisconsin Station (R. 1889, p. 42) showed an average daily variation of from 1.18 to 1.8 pounds of milk, and the yield of fat per day fluctuated about 8 per cent.

The manner of milking also affects the composition of the milk. It was found that cows which ordinarily gave milk with 4 and 5 per cent of fat, respectively, gave milk with only 2.7 and 3.92 per cent. respectively, when milked one teat at a time. The milk was richer in fat when milked rapidly (three to four minutes) than when milked slowly--double that time—though the yield seemed not to be affected. (Wis R. 1889, p. 44.)

The Wisconsin Station (R. 1889, p. 42) found that change of milker, manner of milking and change of environment all exert a more or less decided influence, temporarily at least, on the quantity and quality of the milk produced, the fat being, as a general rule, more sensitive to such changes than the other ingredients or the total yield of milk.

The excitement attendant upon dehorning also has different effects upon the milk of individual cows Often cows in the same barn which were not dehorned showed the effects on yield and composition of milk quite as much as those dehorned. In all cases the effects were only temporary, lasting from one to five days. In general the fat was the ingredient most likely to be affected, and this, together with the yield of milk, was slightly diminished.

The yield of milk and butter by the individual cows in herds varies between wide limits As a method of control, the determination of the fat in the milk of each cow is of great value For example, according to Hansen, the differences between the best and poorest cow in the herds supplying the Kildebrönde creamery in Denmark were as shown in the following table :

COW.	YIELD PER YEAR.		Milk required to make 1 lb of butter.	Value of butter and skim milk.	Cost of food.	Cost of 1 lb of butter.
	Milk	Butter				
	Pounds.	*Pounds.*	*Pounds.*	*Dollars.*	*Dollars.*	*Cents.*
Best, ...	8623	387.4	22.2	118.76	53.27	15.1
Poorest .	3715	128.8	28.7	41.91	51.26	43.8

From this it will be seen that while the cost of the food was almost the same, the best cow produced two and one-half times more milk and three times more butter than the poorest cow.

The sanitary factors regulating the purity and composition of milk and the health of the cattle, are also set down under six heads, which are enlarged upon not only below but under various heads in the present article. They have been made a special subject of investigation by the inspectors.

7. *General Sanitary Conditions and Care.*

It would be eminently desirable to have illustrations and plans showing the most improved forms of construction now adopted by architects for dairy buildings under the combined suggestions of dairymen, veterinarians and inspectors. Everything which tends to increase the physical comfort and well-being of the cattle, also tends to increase their value as beef and milk producers, and this idea has found expression in the admirable devices of the modern dairy.

As to cleanliness, the particular in which improvement is desirable, even in the best stables, is with regard to the use of straw in bedding the animals and absorbing the spatter and manure. When straw becomes damp and filth-stained and then raised to the temperature of blood heat by the cattle lying upon it, such straw becomes a most prolific breeding ground for bacteria. With all the experiments which have been made to exclude the bacteria from the milk during the short interval in which it is squirted through the air from the teats to the milk-pail, but partial success has yet been obtained The cattle have been groomed previous to milking; their udders have been washed; the milkman has been required to change his working clothes for a clean washed smock, and to wash his hands and remove the offensive dirt from his finger-nails (which is otherwise washed out by the warm milk and carried into the pail), but as yet the results, though showing a vast improvement, are not, by any means, what they ought to be. Every movement of the animal and the milkman raises up a cloud of bacterial dust from the bedding, and until some substitute can be provided this dust will continue. Sand and sawdust have been used, but they are both objectionable; they stick to the hair; and the latter especially gives the animal a dirty and woe-begone appearance, as well as being liable to get into the milk. Experiments are now in progress in which no bedding is used. The animal lies upon a clean inclined plank floor. This is made waterproof and its seams properly caulked. To get rid of the manure and spatter, these are removed immediately. Great fun, for the past century, has been made of the cleanly Hollanders, but the cleanliness of their dairies, which was scoffed at as excessive, has been justified by the last ten years' discoveries in bacteriology. Their eminence as breeders and keepers of cattle has been found to be due to cares and precautions that their less successful competitors despised to exercise.

In a large and well-appointed stable, one lad should be constantly busy in grooming the cattle, scrubbing the floors and stalls, removing the manure and cleansing the drains, cleaning the walls and windows and wiping the wood-work with some cheap disinfecting solution.

The open pail is also objectionable. Pails closed at the top, but with round openings closed by a filtering medium, are now being experimented upon and have given encouraging results.

8. *Water-Supply.*

In one case the spread of typhoid fever was ascertained to be due to the contamination of a well located in the barn-yard of a dairy farm where one of the inmates had been ill with the disease. The waters of many other dairies have been examined, where their surroundings were questionable, and, when unsafe, their use has been prohibited by the State Dairy Commissioner.

11. Cooling and Handling the Milk.

As yet the necessity of immediate cooling of the milk to insure its wholesomeness and keeping qualities is generally, but not universally, appreciated. An inspector reported that one milkman, with a delivery of 700 quarts per day, obtained the milk from certain farms in an uncooled condition and claimed that his customers preferred it in that state The report goes on to state :

"His milk-house is situated close to a filthy hog-pen which is banked up by piles of reeking manure, and the well from which he draws the water to wash the cans is directly alongside the hog-pen and the cans are placed on the roof of the pen to dry. In addition to the general dirty appearance of the place a loaded swill wagon is kept standing near the milk-house from which contaminating odors are constantly emanating His cans are kept reasonably clean.

"Mr * * * was notified that he must change his methods regarding the keeping of milk and washing of cans, and to at once cease the sale of uncooled milk.

"The following diagram shows the situation of building, &c." [Omitted.]

Unfortunately I could not make either a satisfactory chemical or bacteriological analysis of the sample of milk accompanying this report because it had utterly spoiled, in its uncooled condition, during transmission. But a more striking instance was afforded in the case of the milk obtained from thoroughbred Jersey cattle which a gentleman maintained at his country seat in order that he might not run the risk involved in purchasing from unknown sources. This gentleman wrote me that he had much sickness in his family, which was certainly due to the milk, but that he was utterly at a loss to account for it, the cows being in perfect condition, and their breed, keep, surroundings, &c., being, as far as he knew, of the best. The farmer in charge of the place brought me, at ten o'clock on the following morning, a sample of this milk drawn at daybreak, and still retaining part of the animal heat. He explained that his instructions had been always to bottle it at once and carry it immediately to the city, in order that it might be used in an entirely fresh condition. The milk was of superior quality, containing 4.87 per cent. of fat, 3.75 per cent. of albumenoids, 4.96 per cent, of milk-sugar and 0.78 per cent. of ash, or a total of 14.36 per cent. of solids. But during the short interval of transmission the bacteria had multiplied to 560,000 per cubic centimeter. The products of their action rendered the milk unwholesome and eventually poisonous.

13. Feed and Fodder.

By simple process of transformation or metabolism the vegetable casein, albumen, fat and amyloids of the feed and fodder are changed into the animal casein, albumen, fat and sugar of the milk. To get milk of the best quality and containing the most of those subtle principles upon which delicacy of taste and aroma depend, the *raw materials* transformed by the cow into *finished product*, in the form of milk, should be of corresponding excellence. The dairy should be located where the land is fertile and soil and climate and ample plant food, both natural and artificial, afford the best of hay and pasture.

Advances in our knowledge of the difficult questions involved in feeding, are only to be derived from the comparison of the results of a vast number of tests performed under rigid conditions, and controlled by chemical analyses with the results of wide practical experience in the management of dairy farms. And while there are necessarily great diversities of opinion and practice, and the conditions which are essential to success are very different in the different sections of our country, nevertheless there is a growing accumulation of generally accepted truths. Many of these are contained in the following summary which is taken from the Handbook of Experiment, Station Work, above referred to:

The effect of food on the milk secretion may make itself apparent in many ways: (1) The quantity may increase or decrease, resulting in a more or less watery milk; (2) the quantity of milk yielded may increase or decrease without any change in the composition of the milk; (3) the proportion of solids to water may change without any change in the quantity of milk yielded, also resulting in richer or poorer milk; (4) the milk may become richer in respect to a single milk ingredient without a change in the other solids; and finally (5) the taste of milk may be affected. The first case involves a change in the water content alone. The second and third cases involve an increased or diminished production of solid ingredients by the milk glands The fourth case involves increased production of a single milk ingredient without a corresponding increase in the others. The fifth case is generally supposed to result from the transmission of quantities from the food to the milk. It has recently been contended by a prominent authority abroad that the composition of milk is less subject to change as a result of feeding than is usually supposed to be the case, and that grain or rich food added to a ration which already meets the food requirements of the animal does not influence the composition of the milk, although it may increase the yield of milk. The change in the relation of the different ingredients of the milk solids to each other, that is, a one-sided increase in the percentage of a single ingredient, has been noticed in only a few isolated cases, and the ability to induce such a change appears to be characteristic of only a very limlted number of foods.

Numerous and varied feeding experiments with cows have been made at our stations, and the results of some of these have thrown light on the effect of food on milk secretion, although a large proportion have had other objects in view. Experiments extending over six years have been made at the Wisconsin Station to compare the effects of corn silage and field-cured corn fodder on milk and butter production. The results of these have not been altogether consistent. In the earlier experiments (R. 1888, p. 28) the indications were that the silage tended to slightly increase the yield, giving a more watery milk. The later experiments (R. 1889, p. 130; R. 1890, p. 80), however, which form the majority, indicate that slightly more milk, and of equally good quality, was produced on silage.

At the Massachusetts State Station, in a long series of comparisons of corn fodder, corn stover and corn silage, these materials were found to compare well, pound for pound, in their effect on yield and composition of milk.

At the Michigan Station the yield of milk was found to be slightly larger on silage than on corn fodder.

At the Maine Station, when corn silage and timothy hay (mostly timothy) were compared, the yield of milk was of equal or better quality on silage than on hay.

At the Vermont Station (R. 1890, p. 86) the milk yield was larger on hay than on silage or corn fodder; the quality of the milk was maintained on silage, but fell off slightly on corn fodder.

At the Massachusetts State Station (R. 1889, p. 82), in four years of comparison of corn stover, corn silage, sugar beets, carrots and hay, the effect of these different foods on the milk was not uniform with different cows, but seemed to be largely a matter of individuality. Both sugar beets and carrots when fed in place of part of the hay of a ration "almost without exception raised the temporary yield of milk, as a rule, exceeding the corn silage in that direction."

The summary in Vermont (R. 1890, p. 73) of a large number of cases where cows were changed from succulent to dry food and *vice versa*, showed practically no change in the composition of the milk which could be attributed to the change of food. The same Station found (R. 1890, p. 107) that the change from barn feed to pasturage was almost universally accompanied by a greater or less increase in both the yield and richness of the milk. According to observations reported in 1891 (Vt. R. 1891, p. 69) the increase on pasturage averaged about one-fourth of a pound of butter per week per cow. These results, together with other observations at the Station in the same line, lead to the statement that "pasture feeding and watery food do not make watery milk."

At the Wisconsin Station (R. 1889, p. 164), on the contrary, "an increase in the amount of water drank was associated with an increase in the amount of milk produced," and "the water in the milk was greatest following the days when the most water was drank."

With reference to the effect of grain feed, a comparison at the Wisconsin Station (R. 1885, p. 97) of old process linseed-meal and cornmeal gave indications that the linseed-meal slightly improved the quality of the milk but usually at the expense of the quantity. Pound for pound, linseed-meal gave slightly larger yield of milk than bran, with no apparent change of quality due to food. (Wis R. 1886, p. 130.) In a comparison of equal weights of ground oats and bran the cows invariably increased in milk yield on oats, with practically no change in fat content of the milk. (Wis. R. 1886, p 65.)

The Maine Station (R. 1885–'86, p. 65; R 1886–'87, p. 84) found from trials in two years that "the substitution of cotton-seed meal for an equal quantity of corn meal unmistakably increased the production of milk and butter to a profitable extent."

At the Pennsylvania Station (B. 17) the substitution of cotton-seed meal for bran was accompanied by an increase of about one-fifth in the yield of milk, with practically no change in percentage of fat in the milk.

The New York State Station (R. 1891, p. 112) substituted cotton-seed meal for corn meal and silage for part of the hay in the ration of seven cows well advanced in milk. The change in the ration was an increase in both albuminoids and fat in the food. Not only was the milk yield maintained for a month on this richer ration at a time when the cows might be expected to be drying up, but in the majority of cases the percentage of fat increased, so that in every case except two there was an absolute increase in the quantity of fat secreted on the richer ration.

The Vermont Station (R. 1890, p 75,) studied the effect on milk of feeding a large rich grain ration as compared with feeding a normal amount. The effect was not uniform with the different cows; one gave no return for the extra grain either in yield or in richness of milk, while two others responded to the extra grain by increased yield of milk, the quality of which was not diminished.

The New Hampshire Station (R. 14,) noticed, in a comparison of gluten meal and corn meal, that, "in almost every case, with each of the eleven cows, a change from gluten meal to corn meal, *i. e.*, a change from narrow to wide nutritive ratio, resulted in a decided falling off in the product (milk), while the reverse change resulted in an equally decided increase."

Probably the most interesting experiment of all, on this subject, was made at the Iowa Station (B. 14), in a comparison of gluten meal with corn-and-cob meal. When gluten meal, containing large amounts of protein and fat, was fed, there was an increase in both the percentage of total solids and fat, and in the total amount of fat produced, in the case of every cow. The proportion of fat to the other milk constituents was noticeably larger on gluten meal. This would seem to be a case of a one-sided increase of the fat, which, as mentioned above, has been noticed in only a few isolated cases. The effect of the gluten meal on the yield of milk was not uniform, but apparently there was little if any change in yield which could be attributed to the food.

From the results cited above it seems safe to assume, for the present, that, in general, corn fodder, corn stover, corn silage, and probably the root crops, do not unfavorably affect either the yield or composition of milk; that succulent foods do not, necessarily, produce watery milk; and that such rich nitrogenous foods as linseed meal, gluten meal, etc., are especially favorable to milk production. The extent to which these foods can be given will, naturally, depend upon circumstances, such as the character of the stock, and the market value of these feeding stuffs, and of dairy products

A study of the influence of the food upon the quality of the milk, has also been made by Dr. Gates, of our own State Agricultural Station. (N. J. Sta. R. 1890; E S. R. 1891, 70-162). Five breeds were included in the best.

The analyses of the foods showed that there was a wide variation from month to month in both the amount and proportion of the food compounds. For example, fifty pounds of corn fodder fed September 1st, contained about the same quantity of food compounds as 100 pounds fed August 1st.

Analyses of commercial concentrated feeds were made and from them a ration prepared similar to the standard daily ration for milch cows of 1,000 pounds weight, viz , 0.40 pounds of fat, 2.50 of protein and 12.50 of carbohydrates. The ration for cows of different weights varied in total amount and not in proportion of the food compounds to each other. It was fed from December 15th to January 1st.

MONTHLY AVERAGE OF MILK OF DIFFERENT BREEDS.

	AYRSHIRE.		GUERNSEY.		HOLSTEIN-FRIESIAN.		JERSEY.		SHORTHORN.	
	Total Solids.	Fat.	Total Solids.	Fat.	Total Solids.	Fat.	Total Solids.	Fat.	Total Solids.	Fat.
August, .	11.76		12.99		12.18	. .	13.37	. .	12.10	.
September, .	12.19		13.56	. .	12.45	.	13.70		12.32	.
November, .	12.44	. .	14.28	.	12.27	. .	14.58	. .	12.95	. .
December, .	12.55	3.61	14 64	5.11	12.26	3.64	14.72	5.02	12.85	3.81
January, .	12 88	3.81	15.29	5.49	12.26	3.68	15.19	5 23	13.44	4 26

These tables show that the large quantity of green fodder used under the conditions which existed (a season of extreme moisture) did not permit of a proper control of the actual food furnished.

When conditions are favorable to proper control the quantity and quality of the milk are improved.

When it is desired to improve the quality, green fodder should be used as a supplement to the ration rather than for the purpose of furnishing the bulk of the food.

By proper selection of materials and balancing of food compounds the cost of rations may be reduced, while at the same time the yield and quality of milk are improved.

During August the average of the milk solids fell below the State standard; in the case of the Ayrshires being only 11.76 per cent., and but little above with the Holsteins, being 12.18 per cent

In quantity the highest average for the five months was attained by the Jerseys, 14.31 ; then the Guernseys, with 14.152 ; Shorthorns, 12,732 ; Ayrshires, 12.364, and Holsteins, the lowest, or 12.284 per cent.

The average composition of dairy products, deduced from American analyses, according to the Report of the Vermont Agricultural Station for 1891 (p. 118), is as follows :

	Total solids, per cent.	Fat, per cent.	Casein, per cent.	Albumen, per cent.	Milk sugar per cent.	Ash, per cent.
Whole Milk						
Average, . . .	13.00	4.00	2.60	0.70	4.95	0.75
Maximum, .	17.00	8.00	3.60	0.90	5.50	0.90
Minimum, . .	10.00	2.00	1.60	0.40	4 00	0.60
Skim milk, . . .	9.75	0.30	2.75	0 75	5.15	0.80
Cream, ...	25.95	18.80	2.00	0.50	4.15	0.50
Buttermilk, ...	9.50	0.50	2.40	0.60	5.30	0.70
Whey, ...	7.03	0.50	0.15	0.78	5.00	0 60
Butter, ...	80.90	85.00	0.60	0.15	. .	0.15
Cheese, ...	66.75	35.50	24.65	. .	4.50	2.10

With regard to the influence of food, the N. Y. Station (R. 1889, p. 587; E. S. R. 1891, p 593) gives the following results of a two-year test upon three Jerseys and two native cows:

When hay alone was fed, the yield of milk, and butter as well, was always the lowest. The addition of eight pounds of corn meal per day increased both the flow of milk and the yield of butter over that of hay alone, but the butter fat in the milk, as shown by analysis, did not increase in proportion to the yield of the milk. The substitution of five pounds per day of linseed meal for six pounds of corn meal, making the grain ration two pounds of corn meal and five pounds of linseed meal, gave a smaller yield of milk than when corn meal alone was fed. The yield of butter fat, nevertheless, was increased in every trial with linseed meal, and in the case of two cows with the same relative increase would amount to more than seventy pounds of butter per year for each cow. Replacing the five pounds of linseed meal with eight pounds of wheat bran, the milk yield was rather less on the whole, but in one case more than when the linseed meal was fed The yield of butter was considerably diminished.

The substitution of oats for the linseed meal was followed by a smaller milk yield and less butter, but of superior quality to that from the linseed meal food.

Of all grain foods tried, gluten meal gave the largest flow of milk, but the per cent. of fat was exceptionally low. Dry feed, a waste product from the manufacture of starch and glucose from corn, ranked next to gluten meal. Corn meal followed these for producing flow of milk. Linseed meal gave the largest amount of butter, but the quality was not of the best, being too soft. Oats gave the best-colored and hardest butter, but was somewhat crumbly. A combination of foods was the most satisfactory butter ration.

A trial was made on five cows by Hills (Vt Station, R; E. S. R. 1891, p. 666) of the relative feeding value of hay, corn fodder, corn silage (frosted and unfrosted), corn stover, the butts and the tops of corn stover, apple pomace silage, Hungarian grass silage, pea and oat hay, and pasture. The trial lasted from November 28th, 1888, to May 22d, 1889, and was divided into eight periods of three weeks each, the first week of each period being regarded as a transition period. The same grain ration was fed to all the cows during the entire experiment, viz., 2.5 pounds wheat bran, 1.5 pounds cotton-seed meal, one pound corn meal, and one pound gluten meal per day. The hay was substituted in separate periods in part or wholly by the other coarse fodders mentioned above, of which the animals were given more than they would eat, and the residue weighed back but not analyzed. "The financial aspect of the case is not considered in this article, but simply the relative amount of product obtained from the different fodders, without regard to their relative cost."

The tabulated data include the feeding record of each cow, analyses of the wheat bran, cotton-seed meal, gluten meal, corn meal, hay, fodder corn, corn stover (both upper and lower half of stalks), apple pomace silage, pea and oat hay and fodder, corn silage, and Hungarian grass silage fed; the yield and analyses of milk, and the amount of milk, solids and fat produced by each cow per pound of dry matter eaten for each of the several periods.

The author discusses these at considerable length, and draws the following conclusions:

1.) Corn fodder and corn silage from the same source had almost equal feeding value in products per pound of dry matter eaten; from different sources average silage proved better than average fodder; both corn silage and corn fodder proved superior to whole stover.

(2.) The lower half of stover (butts) proved to have equal feeding value with the upper half (tops), pound for pound of dry matter in each.

(3) Hay and corn stover had much the same effect on milk production.

(4.) Corn silage from frost-bitten corn, poorly made, proved inferior to that well made from unfrosted corn.

(5.) Apple pomace ensiled, and used supplementary to and in part as a substitute for corn silage, is relished by cows, and appeared by four tests to be about equivalent in feeding value to corn silage.

(6.) Pea and oat hay was not relished, but such as was eaten proved decidedly better, pound for pound, than any other fodder used.

(7) Good corn silage caused gain in all respects over good hay.

(8.) Hungarian grass silage was fed at great loss as compared with corn silage. It gave with one cow the same (one a little better), with two others, poorer results than did good hay, being, on the whole, of nearly equal value with it

(9.) The error inherent in feeding trials such as here reported may be considered to be, on the whole, approximately four per cent. of the larger yield.

(10.) Water below 40° Fah. was drunk as freely as when warmer, and less was drunk when the barn temperature was about normal (50° Fah.) than when warmer or colder.

(11.) No relation was traced between nutritive ratio of fodders and the products formed or between the albumenoids of the food and the casein of the milk.

(12.) When changes in total solids take place the fat is most likely to vary, casein next, and sugar and ash least.

(13) Generally speaking, as milk flow shrinks the percentage of solids increases, but the gross amount of solids decreases Cows in calf change quality and quantity of milk more rapidly than farrow cows, and cows in pasture less rapidly than when barn-fed.

(14.) One season's experience indicates the following as true for the station herd: In changing from barn to pasture feed of equal feeding value, the quality of milk changes differently in different animals, there being usually a gain in per cent. of solids, casein and sugar, and a loss in per cent. of fat; the gross amounts of the ingredients almost invariably increase. Animal individuality plays so great a part in the marked change from barn to pasture feeding that the statement of the nature of the change in quality should not be understood to be of general application.

A very valuable summary of the records of the rations fed to dairy cows by farmers has been made by F. W. Woll,* and presented in abstract by E W. Allen, in the Experiment Station Record, Vol. V, p 884.

The 100 rations here published are those fed by farmers in twenty-three States and in Canada. The data given include the number of cows giving milk, breed, average weight of the cow, annual yield per cow, the purpose for which the cows are kept (milk, butter or cheese), and the amounts of the various constituents of each ration fed per animal daily. From these data a summary is given showing the amounts of digestible nutrients in each ration, and these are summarized by States The statistics were obtained by addressing a large number of representative farmers through the mails and selecting from the replies received 100 which were fairly complete The full statistics for these were then supplied by additional correspondence.

---

* Wisconsin Sta. Bul. No. 38, Jan., 1894, p. 47.

In summarizing the results the author says:

Number of Cows.—The hundred herds, the feeding of which we are considering in this bulletin, contained in the aggregate 2,921 cows in milk during the winter of 1893; the herds contained from 5 to 150 animals, the average number being 29 animals

Breeds Represented.—Nearly all the different breeds of milch cows found in this country are represented in the herds; the Jerseys lead, and next in number come the Holsteins, Shorthorns, Guernseys and Ayrshires, in the order given, with single representatives of the Brown Swiss, Red Polled, and Devon cattle

Yield of Milk and Butter.—Referring to the comment on these figures, we note that the average annual yields of milk and butter reported were 6,314 pounds, and 303 pounds per head, respectively; sixty-eight farmers reported their average yields of milk, and fifty-one those of butter. The yields range from 3,000 to 12,000 pounds of milk, and from 165 to 497 pounds of butter.

Average per cent of Fat in Herd Milk.—The average per cent. of fat in herd milk was reported by fifty-four farmers; the figures range between 3, 5 and 6 per cent , with a general average of 4.59 per cent.

The farmers giving the average fat content of their herd milk were not always the same as those reporting the annual milk and butter product per cow, so that the average figures for these data are not directly comparable. In going over all the figures carefully it seems very likely that the average yield of butter reported is very nearly correct. While it may have been overestimated in some cases, in others no allowance was made for the milk consumed as such, so that the average may be considered about right—that is, a little more than 300 pounds of butter per year per cow. * * *

Time During which Cows Go Dry—As it will be learned by a glance at the tables, the practice followed by the majority of farmers in regard to the drying off of cows is to give them a rest of from one to two months previous to calving. Some farmers report that they cannot dry off their cows, or only with difficulty, but they are in the minority. The practice of milking up to the time of calving is strongly condemned by the best authorities It impairs the constitutional strength of both mother and calf, and reduces the production of milk or butter during the subsequent period of lactation. * * *

Feeding Stuffs Used.—The list of rations given includes three succulent feeds, eighteen coarse dry fodders, twenty-seven concentrated feed stuffs, six kinds of roots and tubers and one miscellaneous feed (skim milk), in all fifty-six different kinds of feeds. The following list shows the number of times which the more important feeds appear in the rations:

Corn silage,	64 times.	Cornmeal,	42 times.
Roots,	13 "	Corn and cob meal,	14 "
Corn fodder and stalks,	35 "	Wheat,	3 "
Mixed hay,	42 "	Oats,	35 "
Timothy hay,	21 "	Barley,	13 "
Oat straw,	16 "	Linseed meal,	37 "
Clover hay,	40 "	Cottonseed meal,	35 "
Wheat bran,	73 "	Pea meal,	6 "
Wheat shorts,	13 "	Malt sprouts,	3 "
Wheat middlings,	11 "	Gluten meal,	8 "

Nutrients in the Various Rations.—As only a few rations were secured from some of the States, the average figures for each State do not offer reliable data for comparison. [Hence the average rations for different sections have been grouped.]

NUTRIENTS IN RATIONS FOR DAIRY COWS.

	Number of rations.	Dry matter.	DIGESTIBLE MATTER.				Nutritive ratio.
			Protein.	Carbohydrates.	Fat.	Total.	
		Pounds	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
New England States, . . .	11	24.28	2.10	13.19	0.75	16.04	1 : 7.1
Middle States, . . .	31	24.65	2 27	13 68	0.82	16.77	1 : 6.8
Central States, ...	20	22 97	1 97	12.78	0 72	15.47	1 : 7 3
North Central States, . . .	21	25.79	2.08	13.79	0.68	16.55	1 : 7.3
Southern States, . . .	2	23.48	2 00	12.14	1.05	15 19	1 : 7.2
Rocky Mountain States, . .	5	30 81	3.12	15.39	0 79	19 30	1 : 5.5
Pacific States, . .	1	21.60	2.68	10.54	0.55	13.77	1 : 4.4
Canada, . .	9	21.57	1.76	11 69	0.63	14.08	1 : 7.4

* * * Including the twenty-eight rations previously published, and combining the New England and Middle States, the Central and North Central States, the Rocky Mountain States, and Washington, we have the following table of summary :

SUMMARY OF RATIONS FOR DAIRY COWS.

	Number of rations.	Dry matter.	DIGESTIBLE MATTER.				Nutritive ratio.
			Protein.	Carbohydrates.	Fat	Total.	
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Eastern States, ...	55	24 38	2.20	13 31	0.77	16.28	1 : 6.8
Middle States, ...	56	24 64	2.08	13.37	0.72	16.17	1 : 7.2
Southern States, . . .	2	23.48	2 00	12.14	1.05	15.19	1 : 7 2
Western States, ...	[illegible]	29.28	3 05	14 58	0.75	18.38	1 : 5.3
Canada, . . .	9	21.57	1.76	11 69	0.63	14.08	1 : 7 4

As will be seen, the average rations fed in the Eastern, Southern and Middle States are very nearly identical. The Canadian rations are all lighter rations than these (with but one exception), while the nutritive ratio is slightly wider. Eight out of nine Canadian farmers reporting, give their specialty of farming as breeding.

The western rations are greatly heavier and of a narrower nutritive ratio, owing to the large extent to which alfalfa enters into the rations. The number of rations secured from these States is too small, however, to allow of generalizations as to the system of feeding practiced there.

Combining all the above 128 rations which have been fed by successful farmers and breeders in the various parts of our continent, we have the following average American ration, as it may be called:

AMERICAN STANDARD RATION FOR DAIRY COWS.

	Dry matter.	DIGESTIBLE MATTER.				Nutritive ratio.
		Protein	Carbo-hydrates.	Fat.	Total	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds*	*Pounds.*	
Average for 128 herds,	24.51	2.15	13.27	0.74	16.16	1 : 6.9

This ratio is practically the same as the [average] one published in Bulletin No. 33 and in our ninth report (E. S. R., Vol. V., p. 502); it is believed that it will be found correct for our American conditions, except, perhaps, for those of the Rocky mountains and Pacific States. While local conditions or the business methods of farming in some places may make a ration desirable which contains more protein than this, and has a narrower nutritive ration as a consequence, we feel confident that in the large majority of cases its adoption will give satisfactory results, and that it is preferable to the German standard ration, so long placed before our stock feeders as the ideal one, the nutritive ratio of which is 1: 5 4. It is the result of American feeding experience. The majority of our most successful dairymen feed in the way indicated by the ration, and we shall not go far amiss if we follow their example.

As the market prices of cattle foods and the local conditions vary to such a great extent with different regions, it is evident that no universal "best" ration for milch cows or for any other animals can be given. It is believed, however, that any dairy farmer can easily select from the abundant material in the preceding pages a ration suited to his condition.

In this work he will find the data given in the N J. Agricultural Station reports for 1892 and 1893 of the greatest service.

INSPECTORIAL WORK IN RELATION TO THE USE OF MILK FOR INFANT FEEDING.

During the past ten years a vastly increased interest has been taken by the general public and by the medical profession in the rigorous inspection of cow's milk, in consequence of a correspondingly higher estimate of the fundamental importance of pure and wholesome cow's milk as the foundation of any system of the artificial nutrition of infants.

It has been demonstrated, in the first place, that infant foods prepared from cereals have been responsible for a great mortality among artificially fed infants. This mortality is due to the inability of infants to digest the starch of which they mainly consist. In the next place, that even when the starch in these foods is changed by heating into the soluble form of dextrin, or when it is changed by the action of malt diastase into the soluble form of malt-sugar, it is even then unsuitable for infant feeding. The final conclusion has been that the best available substitute for mother's milk, is cow's milk, or rather, cow's milk so altered by dilution with water, and so modified by treatment of its albuminoids with proper reagents, that this modified cow's milk is closely analogous to mother's milk. It is converted into what may properly be termed *humanized* milk.

At the present time the number of mothers unable to nourish their infants, either wholly or in part, is very great, and it is constantly increasing. Hence the paramount necessity that the cow's milk, to begin with, should be the whole milk of a healthy, properly fed cow, and that it should reach the child with no alteration, contamination or infection. It is sometimes urged that inasmuch as cow's milk should be diluted with water in order to render it easily digestible by infants, there is no propriety in insisting that its total solids should reach the standard of twelve per cent. But this argument is false, for the reason that cow's milk when fed to infants should be a superior nutritious milk, which milk, falling below the standard, is not Moreover, if the milk has been impoverished by a prior addition of water beforehand, it is impossible to modify it, according to system and rule, so as to get a true equivalent of mother's milk afterwards.

The milk of a healthy, non-tuberculous cow contains no germs or bacteria so long as it is in the udder. These are added from the outside, from air, dirt, water used in washing the cans, etc. Hence the absolute need of cleanliness. Moreover, as the bacteria grow with great rapidity in warm milk, the further need of cooling the milk to 50° or lower without delay. Three systems of dealing with milk, in order to get rid of the changes and dangers due to bacteria have been followed:

1. *Pasteurization*—This consists in heating milk to 165° to 185° and then cooling. If the lower temperature is maintained for ten minutes it destroys the ordinary disease germs. The process is simple and is described in full by the author in the report of the State Dairy Commissioner for 1891.

Confirmation will be found in the results obtained by Lunde (E S. R. IV., p. 381). Milk of a certain farm in Jutland, which had produced butter commanding the highest price, became infected in such a manner that the butter manufactured from it could not be marketed. It was found that the bacteria which caused this abnormal condition of the milk could be killed by heating, and this fact was taken advantage of in practice.

Trials were first made in which the cream was Pasteurized by heating at 65° to 70° C. and at 85° C., cooling rapidly and churning the cream sweet. For purposes of comparison butter was also made from sweet and sour cream not Pasteurized. The sweet cream butter was superior to that made from sour cream, but neither was equal in quality to that made from Pasteurized cream. The butter from cream Pasteurized at 85° C. had a "cooked" taste, which was not the case with that from cream Pasteurized at 65° to 70° C.

As a result of these trials it was demonstrated that first quality butter could be produced from milk which otherwise produced butter unfit for use by Pasteurizing the cream and then souring it with buttermilk from a good creamery.

The keeping quality of the butter was also improved.

2. *Sterilization.*—This is also described in full in the report for 1891. And, in the same place, the added expense and the disadvantages are pointed out. At present much milk is being sold as "sterilized" which is not sterile. Of three samples submitted to me by the inspector one was sterile, one contained 100 bacteria per cubic centimeter, and a third 250 bacteria. They had the flavor of cooked milk, but there was no evidence that they had been handled and bottled in such a manner as to insure the delivery of a truly sterile milk.

3. *Certified Milk.*—The third plan is to prevent as far as possible the entrance of bacteria into the milk. This plan has been successfully carried out under the supervision of a special committee of the Essex County Medical Society, and the milk thus produced, after a due system of examination by the officers and members of this committee, has been designated as "certified milk." Inasmuch as the State Dairy Commissioner has gone into the subject at length in his report for 1893, it is sufficient to say that the work has been prosecuted with growing success and favor. It has been found possible to provide milk containing only a few hundred, instead of from 10,000 to 60,000, bacteria, per cubic centimeter, as most market milk does. Moreover, the precautions are such that no pathogenic bacteria can find their entrance into the milk.

The analyses which are made twice a month give not only theper-centage of fat, but of the albuminoids and other constituents. Upon these analysis the physicians base their formulæ for the preparation of the modified or humanized milk for infant feeding.

INSPECTION OF CONDENSED MILK.

The number of brands of condensed milk is very large, but only those will be alluded to here which are sold in the State of New Jersey. The list given below may not be quite perfect but it is nearly so. In 1891 many of the brands, both of milk condensed with cane sugar and of those condensed without the aid of cane sugar, were examined by Prof. H. B. Cornwall, and his results are stated in the

Report of the Dairy Commissioner for that year. During the present year a hue and cry was raised, by articles published in the newspapers, that much of the can condensed milk is contaminated, impure and unwholesome. I was requested, therefore, to examine those which were being retailed by the shops at the time at which this outcry was being made This was during the past summer. What the age of each sample was I had no means of ascertaining, but all the cans came to me in good condition. The contents in all cases but one had the ordinary smell of condensed milk, and many of them were neutral to litmus paper. Others were faintly acid. This is not surprising when we consider that ordinary market milk is also faintly acid, and that milk begins to acquire an acid reaction very shortly after being taken from the cow. In the exceptional case alluded to the condensed milk was quite acid and had thickened down into a mass with the smell, taste and consistency of soft cheese. The most probable explanation is, that some of the milk from which this condensed milk was prepared had undergone changes, through the action of bacteria. These had developed the acidity and cheesy character before it had been condensed. The only method of determining whether any products of decomposition or ptomaines had been developed by bacterial ferments, which might be either unwholesome or dangerous, would have been to have experimented with it upon animals. But, as a matter of fact, a person opening such a can of milk would at once notice its unusual and spoiled condition

TABLE I.

CONDENSED MILK WITH CANE-SUGAR. (LEEDS.)

BRAND.	Board of Health No.	Dairy Commis. Number.	COLOR.	TASTE.	SMELL.	REACTION.
Tip-Top.	1		Reddish-brown.	Very sweet.	Normal.	Very slightly acid.
Eagle.	2		Yellowish-brown.	Sweet and pleasant.	Normal.	Nearly neutral.
Champion.	3		Yellowish-brown.	Sweet and dry.	Normal.	Nearly neutral.
Daisy.	4		Brownish-white.	Sweet and dry.	Normal.	Nearly neutral.
Full Weight	5		Yellowish-brown.	Sweet.	Normal.	Neutral.
Sweet Clover.	6		Light yellowish-brown	Sweet.	Normal.	Nearly neutral.
Challenge.	7		Dark yellowish-brown	Sweet.	Normal.	Neutral.
Magnolia.	8	8206	Nearly white.	Cheese.	Cheese.	Acid.
C. & S.	9		Yellowish-brown.	Sweet.	Normal.	Neutral.
Atlas.	10		Brownish-white.	Sweet and pleasant.	Milk.	Slightly acid.
Leader.	11	8205	Light brownish-white	Sweet.	Normal.	Slightly acid.
Standard.	12		Brownish-white.	Sweet.	Normal.	Nearly neutral.
Winner.		8203	Reddish-brown.	Butter.	Slightly of cheese.	Nearly neutral
Bell.		8204	Yellowish-brown.	Sweet and pleasant.	Normal.	Nearly neutral.
Red Cross.		8207	Brownish-white.	Sweet—unpleasant.	Unpleasant.	Slightly acid.

It is not within the powers of the chemist to protect consumers who would use an article of food which was manifestly spoiled, except by warning and calling attention to the existence of such spoiled goods. The case is different in regard to the presence of poisonous bodies, such as lead, tin, etc., or of adulterations which might exist, and yet give no indication except to chemical tests.

With one exception, all the samples of canned milks which have been examined, have been made of whole milk of good quality and without adulteration.

To find how many times the original milk has been condensed, the percentage of milk solids found by analysis has been divided by 12.5, which is assumed to be the average amount of solids in whole milk. To get the percentage of fat in the original milk, the percentage of fat in the condensed milk is divided by the figures which represent the number of times the milk was condensed. The quotient in most cases is over 3.5 per cent , and when such is the case, the presumption is strong against any skimming of the original milk.

In making the analyses, the total solids and ash were determined in the usual manner.

The albuminoids were determined by Ritthausen's method That is, five cubic centimeters of the diluted canned milk (one milk to four water) was made up to 100 cubic centimeters with water, and the albuminoids coagulated with copper sulphate solution, sufficient alkali being afterwards added nearly to neutralize. After filtering and drying to tacky consistency, the precipitate was treated with ether in a Soxhlet apparatus to extract the fat It was then dried, weighed and burned The weight of the ash, subtracted from that of the preciptate, gave the percentage of albuminoids.

The fat obtained as above was weighed after distilling off the ether. It is important to note that the result thus obtained was identical with that obtained by Adams' method, but the albuminate of copper required a greater number of syphonings with ether in the Soxhlet than the dried milk on the paper coil in the Adams method.

TABLE II.

CONDENSED MILK WITH CANE-SUGAR (LEEDS).

BRAND.	Board of Health Number.	Dairy Commission Number.	PERCENTAGES.								Times Condensed.
			Water	Fat.	Caseine and Albumen	Milk-sugar	Ash	Cane-sugar	Milk Solids	Fat in Original Milk	
Tip Top, . .	1	. . .	26.00	10.17	9 22	11.37	1.99	41.25	32 73	3.88	2.62
Eagle, ...	2	. . .	28.32	9 11	9.06	10.11	1.91	41 49	30.19	3.78	2.41
Champion, ...	3	. . .	27.72	9.60	9 52	10.11	1.83	41.22	31.06	3.87	2.48
Daisy, ...	4	. . .	25.53	9.41	8 71	13 43	1.83	41.09	33 38	3.52	2.67
Full Weight, ...	5	. . .	28.18	9.00	7 87	11.70	1 88	41.37	30.45	3 70	2.43
Sweet Clover, ...	6	. .	28.70	10 30	8.47	11.31	1.83	39.39	31.91	4.17	2.47
Challenge, ...	7	. . .	28.44	9.86	8 99	10.05	1.82	40.84	30 72	4 04	2.45
Magnolia, ...	[illegible]	8206	30 04	9.48	8.17	12.81	1.91	37.59	32.37	3 66	2.59
C. & S., . .	9	. . .	26.99	9 11	8.68	16.98	2.15	36.09	36.92	3 09	2.95
Atlas, ...	10	. .	28.30	7.64	10.91	10 79	1.83	40 53	31.17	3 06	2 49
Leader, ...	11	8205	28.20	8.02	8.01	11.32	1.80	42.65	29.15	3 44	2.33
Standard, ...	12	. . .	27.21	7.79	8.21	13.30	1.85	41.64	31.15	3.12	2.49
Winner, ...	. . .	8203	29.84	9.63	9.82	11.17	1.98	37.56	32 60	3 70	2.60
Bell, ...	. . .	8204	25.54	12.13	8.87	10 51	2.05	40 90	33.56	4 52	2.68
Red Cross, ...	. . .	8207	29 34	8 80	7.81	10 00	1.76	42.29	28 37	3 87	2.27
Average, ...			27.89	8.67	8.82	11.66	1 83	40 39	31 71	3 69	2 52

It will be noted that the amount of condensation varies between 2.33 times and 3.06 times. In only one instance does the condensation exceed three times. Most of the labels direct that the milk should be diluted between three and four times for ordinary use. This is proper, because the added cane sugar, which amounts to between 35 per cent. and 42 per cent., would make the milk, if diluted to the exact figures given in the table, considerably more dense than the original milk. But other labels call for a dilution between four and five times, which is excessive, inasmuch as these milks are not more condensed than those which call for a dilution between three and four times.

In fact a limit to the condensation is established by the nature of the milk-sugar. This requires from five to six parts of cold water to dissolve it, and there being less than this ratio of water to milk-sugar in the condensed milk, in certain instances, some of the milk-sugar crystalizes out. It forms hard, white, transparent crystals, which do not dissolve very readily, and so give a gritty feeling on the tongue when the condensed milk is tasted This grittiness oftentimes originates a prejudice against condensed milk, since it is supposed to be due to some impurity. To overcome this false notion some of the labels call attention to the gritty taste and state that this taste, being due to the presence of milk-sugar, is positive proof of the purity of the fresh milk used in manufacture. Of course this is an overstatement, since the milk might be impure and yet all of its milk-sugar might be present.

TABLE III.

CONDENSED MILK WITH CANE-SUGAR (CORNWALL).

BRAND.	Dairy Commissioner number	PERCENTAGES.								Times condensed.
		Water.	Fat.	Caseine and albumen.	Milk-sugar.	Ash.	Cane-sugar.	Milk solids.	Fat in original milk.	
Tip Top, . . .	3774	23.45	11.49	9.08	11.95	1.97	42.06	34.49	4.16	2.76
Peninsular, . .	3800	27.33	9.02	8.85	12.07	1.83	40.90	31.77	3.55	2.54
Bell, . . .	3803	26.83	10.38	9.33	16.99	1.53	34.94	38.23	3.39	3.06
Peninsular, . .	4530	24.67	9.28	8.77	12.10	1.89	43.29	32.04	3.62	2.56
Superior, .	4529	25.76	11.37	8.72	11.38	1.92	40.85	33.39	4.25	2.67
Full Weight, .	4531	25.44	10.31	9.10	11.45	1.97	41.73	32.83	3.93	2.62
Standard, .	4532	24.14	9.97	8.08	11.13	1.92	44.76	31.10	4.00	2.49
Champion, . .	4533	28.08	9.15	9.24	11.37	1.81	40.35	31.57	3.63	2.52
Anglo-Swiss, .	4534	22.74	10.38	8.45	12.74	1.79	43.90	33.36	3.89	2.67
Average, . .	. . .	25.38	10.15	8.85	12.35	1.85	41.42	33.24	3.93	2.65

It is evident that in the process of condensation the natural color of milk is intensified. But some of the condensed milks have quite a decided brownish tinge. This is due to a change in the fat. After extraction with ether the fat obtained in the process of analysis from condensed milk frequently has a tint of brownish yellow, while the fat similarly obtained from ordinary milk is nearly colorless or with a slight yellowish tint

Some of the condensed milk is not uniform, the great bulk of the milk being comparatively thin, with floating lumps of a buttery consistency. Many of the labels state that the best of whole, fresh milk is employed together with the best refined cane sugar. It certainly would not be profitable to use any other. If the milk were watered this water would have to be evaporated off, and if the milk were skimmed the condensed milk, after dilution with water, would be manifestly poor and watery. If the cane sugar was not well refined, constituting as it does about 40 per cent of the milk, it would give a dark-colored, unsalable product. Even when the process is begun upon the best materials, it is no small triumph of manufacturing art to carry on *in vacuo* and with proper stirring and without overheating the condensation of a material so sensitive to change as milk is, and produce the nearly white, uniform and sweet product obtained in most instances.

The manufacturer can, and usually does, protect himself against the use of skimmed and altered milk. But there are changes brought about by bacterial ferments, which in their incipient stages are difficult to detect, and which require a bacteriological examination There may be a change in the albuminoids of the milk without souring and curdling Such milk may be condensed successfully and then go on altering in the cans until it becomes semi-solid or even, as the phrase is, "goes hard" Finally the decomposition may proceed to the liberation of gases, swelling the can, and finally to a bad-smelling, putrefied and poisonous product.

The use of a very small amount of such decomposing milk may spoil hundreds of cans. The manufacturer arranges with the dealer to return all such spoiled goods, and the individual consumer can also claim the same privilege at the hands of the dealer. These precautions, together with frequent inspections and analyses, will do much to protect the consumer But the manufacturer should avail himself of bacteriological examinations as a matter of self-interest.

For the preparation of coffee, tea, chocolate, pastry and other purposes in cooking, milk condensed with sugar has been a most important addition to the list of valuable and wholesome food substances. But this is not true of its use in infant feeding, for which it is utterly unsuitable. When so used, the directions are to dilute from seven to ten times This great dilution overcomes the difficulty often arising in the use of fresh cows' milk from the indigestibility of the large percentage of curd. But milk thus prepared contains cane-sugar, which is a fermentable substance not naturally present in milk, and which is a fat-producing, not a bone-and-tissue-forming substance. The consequence is that infants thus fed often rapidly increase in size and weight, while the general nutrition is inadequate and the system readily succumbs when attacked by disease.

These objections do not apply to the milk condensed without the aid of milk-sugar, and I have added here the following table of analyses performed by Prof. Cornwall on samples submitted to him by our State Dairy Commission:

TABLE IV.

CONDENSED MILK WITHOUT CANE-SUGAR. (CORNWALL.)

DAIRY COMMISSION NUMBERS.	PERCENTAGES.							
	Water.	Fat.	Caseine and albumen.	Milk sugar.	Ash.	Milk solids.	Fat in original milk.	Times condensed.
3772, .	58.17	12.28	12.58	14.33	2.44	41.83	3.67	3.34
3773, .	58.29	12.35	11.14	15.29	2.59	41.37	3.73	3.31
3775, .	57.54	12.72	11.37	15.44	2.53	42.46	3.75	3.39
3776, .	58.82	11.43	11.44	15.40	2.49	41.18	3.47	3.29
3777, .	55.60	12.68	14.20	15.05	2.47	44.40	3.57	3.55
3778, .	56.36	12.65	13.58	14.61	2.45	43.64	3.62	3.49
*3911, .	69.43	9.78	7.72	11.22	1.78	30.57	4.01	2.44
4917, .	57.28	12.71	13.62	13.96	2.43	42.72	3.71	3.42
Average, .	58.93	12.07	12.32	14.41	2.40	42.04	3.69	3.28

* This was in a sealed can, labeled "Evaporated Cream." All the others were sold in bulk. Although apparently made from good milk, the "Evaporated Cream" is much inferior to the other samples.

This kind of condensed milk is, in itself, a more valuable product. inasmuch as the cane-sugar, which is left out, is represented by about one-fifth more of the original milk. But, for this very reason, and also because the absence of the cane-sugar, which is an excellent preservative agent, renders it more difficult to keep, the milk condensed without cane-sugar is less merchantable than that which is. Moreover, it is more liable to attack the tin, and should be preserved not in tin, but in glass jars.

Laws of New Jersey Relating to Oleomargarine.

AN ACT to prevent deception in the sale of oleomargarine, butterine or any imitation of dairy products, and to preserve the public health.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That no person shall offer or expose for sale, or sell, or have in possession for the purposes of sale, any oleomargarine or butterine or suine, or any substance in imitation or semblance of natural butter or cheese, or any substance that is rendered, made, manufactured or compounded out of any animal or vegetable or mineral fat or oil, not produced from pure milk or cream from pure milk, unless contained in or sold out of or in tubs, pails, firkins, vessels or other packages marked and labeled as required by section three of this act.

2. *And be it enacted*, That no person shall offer or expose for sale or sell, or have in possession for the purpose of sale, any mixture or compound of natural butter or cheese with oleomargarine, butterine, suine, or any animal or vegetable or mineral fat or oil, or any substance not the product of pure milk or cream from pure milk, except such mixture or compound shall be sold out of or in or contained in tubs, firkins, pails, vessels or packages marked or labeled as required by section three of this act.

3. *And be it enacted*, That no oleomargarine, butterine or suine, or any substance or compound or mixture in imitation or semblance of natural butter or cheese, or any substance that is rendered, made, manufactured or compounded out of animal or vegetable or mineral fat or oil, not the product of pure milk or cream from pure milk, shall be sold or exposed or offered for sale, or held in possession for the purposes of sale, except when contained in tubs, pails, boxes, firkins, vessels or other packages that are marked or labeled as follows, to wit: every such tub, pail, box, firkin or other vessel or package shall have painted on the outside thereof and midway between the top and bottom thereof, a stripe or band, at least three inches wide, and extending completely around said vessel or package, and said stripe or band shall be painted with black paint ; every such vessel or package shall have legibly branded and burnt in, by means of a branding or burning iron, on the outside of the cover and on the outside of said vessel or package, in two places, as nearly opposite each other as possible, the words, ' oleomargarine," "butterine," "suine" or "imitation butter," or "imitation cheese," as the case may be, and said name or title shall be composed of Roman letters at least one-half an inch high and at least one-quarter of an inch broad, and said name or title shall be

at least ten inches long; and every such tub, pail, box, firkin or other vessel or package shall bear a label or shall have branded on it a mark giving the name and address of the maker of the contents thereof, and the name and location of the manufactory.

4. *And be it enacted*, That no person shall sell any oleomargarine, butterine, suine or any substance in imitation or semblance of natural butter or cheese, or any substance that is rendered, made or manufactured or compounded out of any animal or vegetable or mineral fat or oil, not produced from pure milk or the cream from pure milk, at retail or in quantities less than the original tub, firkin or other package, unless he shall first inform the purchaser that the substance is not natural butter or cheese, but is imitation butter or cheese, and at the time of sale, and with each sale, he shall give to the purchaser a card or notice, printed, on which shall be the name of the substance sold and the name and address of the seller or vendor, and said notice or card shall be at least six inches long, and at least four inches wide, and the printing thereon shall be in letters at least of the size known as two-line English, and said notice or card shall be printed in black and in the English language.

5 *And be it enacted*, That no person shall offer or expose for sale, or sell, or have in possession for the purposes of sale, any oleomargarine, butterine, suine or any substance in imitation of natural butter or cheese, or any substance that is rendered, made, manufactured or compounded out of any animal or vegetable or mineral fat or oil, not produced from pure milk or cream from pure milk, that is colored, stained or mixed with annatto or any other coloring matter or substance.

6. *And be it enacted*, That for the purposes of this act the terms "natural butter," or "natural butter or cheese," shall be taken to mean the product or products usually known by these names and which are made and manufactured exclusively from milk or cream or both, with salt or salt and rennet, and with or without coloring matter or sage ; and the terms "oleomargarine," "butterine," "suine" or "substance in imitation or semblance of natural butter or cheese," shall be taken to mean any substance that is rendered, made, manufactured or compounded out of any animal, vegetable or mineral oil or fat, not the product of pure milk or the cream from pure milk ; also, any compound or mixture of natural butter or cheese, or milk or cream, with any of these substances not milk or cream.

7. *And be it enacted*, That the possession by any person who is either manufacturer, merchant, broker, wholesale or retail dealer, or a hotel, inn, restaurant or boarding-house keeper, of any oleaginous substance, mixture or compound whatever as defined by this act, not natural butter, that is not contained in a tub, box, pail or vessel, plainly marked and branded in accordance with the provisions of section three of this act, shall be prima facie evidence of intent to sell the same

8 *And be it enacted*, That no person shall in any way or manner erase, cancel or obliterate deface, or cover over or remove either the band or stripe of paint, or the brands required by section three of this act to be

placed on the tub, box, pail or vessel containing any oleaginous substance, mixture or compound as defined by this act.

9. *And be it enacted*, That every person who shall violate any of the provisions of this act shall be liable to a penalty of one hundred dollars for the first offense, and two hundred dollars for each second or subsequent offense.

10. *And be it enacted*, That every district court in any city, and every justice of the peace in any county, and any recorder in any city, is hereby empowered on oath or affirmation made according to law that any person or persons has or have violated any provision of this act, to issue process at the suit of the commissioner herein named as plaintiff for the use of the state of New Jersey, either in the manner of a summons or warrant, against the person or persons so charged, which process shall, when in the nature of a warrant, be returnable forthwith, and when in the nature of a summons, shall be returnable in not less than one nor more than ten entire days ; such process shall state what provision of the law is alleged to have been violated by the defendant or defendants ; and on the return of such process, or at any time to which the trial shall have been adjourned, the said court, justice of the peace or recorder shall proceed to hear testimony and to determine and give judgment in the matter, without the filing of any pleadings, for the plaintiff, for the recovery of such penalty, with costs, or for the defendant ; and the said court, justice of the peace, or recorder shall, if judgment be rendered for the plaintiff, forthwith issue execution against the goods and chattels and person of the defendant or defendants ; and the said court, justice of the peace, or recorder is further empowered to cause any such defendant who may refuse or neglect to pay the amount of the judgment rendered against him, and all the costs and charges incident thereto, unless an appeal is granted, to be committed to the county jail for any period not exceeding ninety days.

11. *And be it enacted*, That the officers to serve and execute all process under this act shall be the officers authorized to serve and execute process in said courts, and before such magistrates and officers as aforesaid, including the constables of such counties and all police officers of such cities.

12. *And be it enacted*, That said district court, justice of the peace, or recorder shall have power to adjourn the hearing or trial in any case, from time to time, not exceeding thirty days from the return of the summons or warrant, and to bail the person so charged in such sum as he may deem proper, for his appearance at such time and place as said trial or hearing shall be adjourned to, and in default of bail to commit the person so charged to the common jail of said county, to be there detained until the trial or hearing of the charge.

13. *And be it enacted*, That either the complainant or defendant, upon paying all costs incurred and by filing with said district court, justice or recorder, within ten days after trial before him, a written notice of his or her intention to appeal from the decision of said court, justice or recorder, may appeal to the next court of general quarter sessions of the peace of the county in which said complaint may have been determined, and said court of general quarter sessions shall proceed and try the same and make

such adjudications as are herein provided in case of such trial before said district court, justice or recorder.

14. *And be it enacted*, That all penalties imposed under this act shall be, immediately on receipt, paid into the treasury of this state by the commissioner.

15. *And be it enacted*, That the state board of health shall appoint a commissioner, who shall be known as the state dairy commissioner, who shall be a citizen of this state and who shall hold his office for the term of three years, and until his successor shall be appointed, and said commissioner shall be paid a salary of two thousand dollars per annum and his traveling and other expenses, payable by the treasurer of this state, on warrant of the comptroller, in quarterly payments; and said commissioner shall be appointed within fifteen days after the passage of this act, and shall be charged with the enforcement of the various provisions thereof; and said commissioner may be removed for just cause by the appointing power conferred by the act; *provided*, that charges shall be first made in writing and he be given time to reply thereto; and the said commissioner shall make annual reports to the legislature not later than the fifteenth day of January in each year, and also to the state board of health at its annual meeting; and said commissioner is hereby authorized and empowered to appoint or employ such assistants, chemists, agents, clerks and counsel as may be deemed necessary for the proper enforcement of this act, their compensation to be fixed by the commissioner.

16. *And be it enacted*, That the said commissioner shall be authorized to expend for the purposes of this act an amount not exceeding ten thousand dollars in any one year, and all expenses shall be paid by the treasurer of this state on warrant of the comptroller, upon presentation of properly certified accounts made by said commissioner, but such expenses shall not exceed in any one year the amount stated in this section.

17 *And be it enacted*, That the said commissioner, and assistants, and clerks and agents, as shall be duly commissioned so to do by the commissioner, shall have full and free access, ingress and egress to all places of business, factories, farms, buildings, hotels, restaurants, boarding-houses, carriages, cars, vessels and cans used in the manufacture and sale of any dairy products, or any imitation thereof; they shall also have the power to open any package, can or vessel containing such articles which may be manufactured, sold or exposed for sale in violation of the provisions of this act, if they have reason to believe it is being violated, and may inspect the contents therein, and may take therefrom samples for analysis

18. *And be it enacted*, That this act and each section thereof is declared to be enacted to prevent deception in the sale of oleomargarine, butterine or any imitation of any dairy product, and to preserve the public health.

19. *And be it enacted*, That an act entitled "An act for the protection of dairymen, and to prevent deception in sales of butter," approved February twenty-first, one thousand eight hundred and eighty-four, and an act entitled "An act to prohibit the manufacture and sale.of impure and imitation dairy products," approved May fifth, one thousand eight hundred

and eighty-four, and all acts and parts of acts inconsistent or in conflict with this act be and the same are hereby repealed.

20. *And be it enacted*, That this act shall take effect immediately.

Approved March 22d, 1886.

CHAPTER CL. LAWS OF 1887.

A SUPPLEMENT to an act entitled "An act to prevent deception in the sale of oleomargarine, butterine or any imitation of dairy products, and to preserve the public health" approved March twenty-second, one thousand eight hundred and eighty six

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That nothing in said act shall be so construed as to permit the sale or the offering or exposing for sale, or the having in possession for the purposes of sale of any olemargarine or butterine, or any substance in imitation of natural butter, that is colored, stained or mixed with annatto or any other coloring matter or substance.

2. *And it enacted*, That section four of said act be and the same is hereby amended so as to read as follows:

[4. That no person shall sell any oleomargarine, butterine, suine or any substance in imitation or semblance of natural butter or cheese, or any substance that is rendered, made, manufactured or compounded out of any animal or vegetable or mineral fat or oil, not produced from pure milk or the cream from pure milk, at retail or in quantities less than the original tub, firkin or other package, unless he shall first inform the purchaser that the substance is not natural butter or cheese, but is imitation butter or cheese, and at the time of sale and with each sale he shall give to the purchaser a card or notice, printed on which shall be the name of the substance sold and the name and address of the seller or vender, and nothing else shall be printed thereon unless it be the weight of the parcel; and said notice or card shall be at least six inches long and at least four inches wide, and the printing thereon shall be in letters at least of the size known as two-line English, and said notice or card shall be printed in black and in the English language, upon white paper, plainly and legibly, and shall be either upon the outside of the outer wrapper in which the substance is delivered to the purchaser or upon a separate card or paper attached thereto; in either case the notice shall be so placed that no part thereof shall be concealed from view.]

3. *And be it enacted* That the state dairy commissioner is hereby directed and empowered to aid in the enforcement of the provisions of an act entitled "An act to prevent the adulteration of food or drugs," approved March twenty-fifth one thousand eight hundred and eighty-one, and said commissioner and his assistants and agents are hereby clothed with the same powers as are conferred on inspectors or officers by the provisions of said act, and the expenses of such enforcement shall be paid out

of the appropriation made for the purposes of the act to which this is a supplement.

4. *And be it enacted*, That the state dairy commission may appoint the chemist or chemists, analyst or analysts, required by the provisions of this act or the act to which this is a supplement, and shall fix the compensation to be paid such chemists or analysts.

5. *And be it enacted*, That the conviction in prosecutions under the act to which this is a supplement shall be in the following or similar form:

STATE OF NEW JERSEY, } *ss.*
COUNTY OF A, }

Be it remembered, That on this ——— day of —— —, at ——— in said county, C D., defendant, was, by the district court of the city of J. (or by the recorder, or as the case is) convicted of violating the ——— section of "An act to prevent deception in the sale of oleomargarine, butterine or any imitation of dairy products, and to preserve the public health," approved March twenty-second, one thousand eight hundred and eighty-six, in a summary proceeding at the suit of A. B , state dairy commissioner, who sues for the use and benefit of the State of New Jersey, plaintiff, upon a complaint made by E F.; and further, that the witnesses in said proceeding who testified for the plaintiff were (name them); and the witnesses who testified for the defendant name them); wherefore the said court (or recorder, or as the case is) doth hereby give judgment that the plaintiff recover of the defendant one hundred dollars penalty, and —— dollars costs of the proceeding.

The said conviction shall be signed by the judge of the district court, recorder or other magistrate before whom the conviction is had; in case of the infliction of a penalty of two hundred dollars, the conviction shall contain a statement that it appeared that the defendant had been previously convicted of violating the said act; when an appeal is taken there shall be sent to the appellate court a copy of the complaint, summons, conviction or judgment and notice of appeal; the costs in prosecutions under the act to which this is a supplement shall be the same as costs in the district courts in actions on contract

6. *And be it enacted*, That this act shall take effect on May first, one thousand eight hundred and eighty-seven.

Approved April 21st, 1887.

Laws Relating to the Adulteration of Milk.

CHAPTER LXXXII. LAWS OF 1882.

AN ACT to prevent the adulteration and to regulate the sale of milk.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That every person who shall sell, or who shall offer or expose for sale, or who shall transport or carry, or who shall have in possession with intent to sell or offer for sale, any milk from which the cream or any part thereof has been removed, shall distinctly, durably and permanently solder a label or tag of metal in a conspicuous place upon the outside of every can, vessel or package containing such milk, and such metal label or tag shall have the words "skimmed milk" stamped, indented or engraved thereon in letters not less than two inches in height, and such milk shall only be sold or shipped in or retailed out of a can, vessel or package so marked.

2. *And be it enacted*, That every person who shall sell or who shall offer for sale, or who shall transport or carry for the purposes of sale, or who shall have in possession with intent to sell or offer for sale, any impure, adulterated or unwholesome milk, and every person who shall adulterate milk, or who shall keep cows for the production of milk in a crowded or unhealthy condition, or feed the same on food that produces impure, diseased or unwholesome milk, or shall feed cows on distillery waste, usually called swill, or upon any substance in a state of putrefaction or rottenness, or upon any substance of an unwholesome nature, shall be liable to the penalties hereinafter provided for in this act.

3. *And be it enacted*, That the addition of water or any other substance or thing is hereby declared an adulteration, and milk that is obtained from animals that are fed on distillery waste, usually called "swill," or upon any substance in a state of putrefaction or rottenness, or upon any substance of an unhealthful nature, or milk that has been exposed to or contaminated by the emanations, discharges or exhalations from persons sick with any contagious disease, by which the health or life of any person may be endangered or compromised, is hereby declared to be impure and unwholesome.

4. *And be it enacted* That in all prosecutions under this act, if the milk shall be shown upon analysis by a member of the council of public analysts of this state, or the chemist of the state experiment station, to contain more than eighty-eight per cent. of watery fluids, or to contain less than

twelve per cent. of milk solids, such milk shall be deemed for the purposes of this act to be adulterated.

[NOTE —Supplement of February 24th, 1887, permits the analysis to be made by any chemist appointed by the State Board of Health.]

5. *And be it enacted*, That every person who shall violate any of the provisions of this act shall be liable to a penalty of fifty dollars for the first offense and one hundred dollars for a second or subsequent offense.

6. *And be it enacted*. That justices of the peace and recorders shall have jurisdiction to try and punish all persons for violating the provisions of this act, and the penalties prescribed in section five of this act, for the violations of any of the provisions of this act, may be enforced before any justice of the peace or recorder in any county where the offense is committed or where the offender is first apprehended.

7. *And be it enacted*, That said justice of the peace or recorder, upon receiving due proof, made before him by an affidavit of one or more persons of the violation of any of the provisions of said act by any person or persons, is hereby authorized and required by his warrant, under his hand and seal, directed to any constable or police officer of his county, to cause such person or persons to be arrested and brought before said justice or recorder, who shall hear and determine the guilt or innocence of the person or persons so charged, and upon conviction of said person or persons, the said justice or recorder is hereby authorized and required to impose upon the offender so convicted before him the penalties prescribed for such offenses; and if any person so convicted shall fail to pay the penalties so imposed, together with the costs of the prosecution, the said justice or recorder is hereby authorized and required to commit such offender to the common jail of said county for a period of not less than ten or more than sixty days; *provided, however*, that an analysis of condemned milk shall be made by a member of the council of public analysts of this state, or the chemist of the state experiment station.

[NOTE.—Supplements provide for a jury trial when demanded and for an analysis by chemists appointed by the State Board of Health.

Sec. 8 provides that a certificate of analysis shall be received as *prima facie* evidence, but as this is not legal no such course should be taken.]

9. *And be it enacted*, That the state board of health is hereby empowered and directed to appoint each year a competent person who shall act as a state inspector of milk, at a salary of eight hundred dollars per annum, payable by the treasurer of this state, by warrant of the comptroller, in quarterly payments, for the purposes of this act, and in addition thereto said inspector shall be paid his actual traveling expenses while in the performance of his duties, and actual expenses of suits and costs of analysis brought by him under this act, payable by the treasurer of this state by warrant of the comptroller; said inspector shall act until removed by said board, or until his successor is appointed, and shall make such reports to

said board at such time as it may direct; said inspector, having reason to believe the provisions of this act are being violated, shall have power to open any can, vessel or package containing milk, whether sealed, locked or otherwise, or whether in transit or otherwise; and if upon inspection he shall find such can, vessel or package to contain any milk which has been adulterated, or from which the cream, or any part thereof, has been removed, or which is sold, offered or exposed for sale, or held in possession with intent to sell or offer for sale, in violation of any section of this act, said inspector is empowered and directed to take a sample of the same for analysis and put into a can, vessel or package, to be sealed in the presence of one or more witnesses, and sent to any member of the council of public analysts or the chemist of the state experiment station, and also to condemn the same and pour the contents of such can, vessel or package upon the ground or return the same to the consignor, and if upon analysis such milk shall prove to be adulterated, shall bring suit against the person or party so violating the law; *provided, however*, that if upon analysis it is proved that the condemned milk is unadulterated, the state shall be liable for the value of the article destroyed, which shall be paid by the treasurer of this state by warrant of the comptroller; and said inspector is empowered to employ one or more assistants, who shall have power to inspect milk as provided by this act, said assistants to be paid not more than five dollars per day for each and every day of actual service in performance of their duties, as provided by this act, payable by the treasurer of this state, by warrant of the comptroller.

[NOTE A supplement provides that the analysis may be made by any chemist appointed by the State Board of Health]

10. *And be it enacted*, That all penalties imposed shall be paid into the treasury of this state, except in case the local board of health of any city, borough, town or township shall prosecute the offender, in which case the penalties shall be paid into the treasury of the city, borough, town or township so prosecuting; *provided*, that in prosecutions by the executive officer of any local board of health, no expense shall be incurred to the state

[NOTE - Sec. 11 repeals all former laws]

Approved March 14th, 1882

CHAPTER XC. LAWS OF 1884.

A SUPPLEMENT to an act entitled "An act to prevent the adulteration and to regulate the sale of milk," approved March fourteenth, one thousand eight hundred and eighty-two

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That at any time previous to the hearing of a complaint against any person under the provisions of the aforesaid act, either party may ap-

pear before the justice or recorder and demand a trial by jury; whereupon the said justice or recorder shall issue a venire facias to summon a jury of twelve men, qualified by law to act as jurors, to try said complaint.

2. *And be it enacted*, That in case the said jury find such person or persons guilty, then the said justice or recorder shall proceed as though he had determined such complaint without a jury; and in case such jury shall find such person or persons not guilty, the said justice or recorder shall enter judgment in his, her or their favor accordingly, with costs.

3. *And be it enacted*, That either party, upon paying all costs incurred and by filing with said justice or recorder within ten days after trial before him, a written notice of his or her intentions to appeal from the decision of said justice or recorder or jury, may appeal to the next court of general quarter sessions of the peace of the county in which such complaint was made and determined

4. *And be it enacted* That either party on appeal may demand a trial by jury, and said court of general quarter sessions shall proceed and try the same and make such adjudications as are herein provided in case of such trial before said justice or recorder.

[NOTE.—Sec. 5 repeals conflicting sections in previous laws.]

CHAPTER CLXXXVI. LAWS OF 1886.

A SUPPLEMENT to an act entitled "An act to prevent the adulteration and to regulate the sale of milk," approved March fourteenth, one thousand eight hundred and eighty-two

[NOTE.—By this act the State Dairy Commissioner is invested with the powers and duties of the Milk Inspector.]

CHAPTER II. LAWS OF 1887.

A SUPPLEMENT to an act entitled "An act to prevent the adulteration and to regulate the sale of milk," approved March fourteenth, one thousand eight hundred eighty-two.

1 BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That the analysis of milk required by the provisions of sections four, seven, eight and nine of the act to which this is a supplement, may be made by any chemist or chemists appointed or designated by the state board of health, the provisions of said act to the contrary notwithstanding.

Approved February 24th, 1887.

CHAPTER CLXXXV. LAWS OF 1885.

AN ACT to prohibit the sale of adulterated and skimmed milk in cities of this state.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That no milk which has been watered, adulterated, or changed in any respect by the addition of water, or other substance, or by the removal of cream, or any part thereof, shall be kept or offered for sale in any city of the first class in this state

[NOTE.—Sec. 2 provides that persons violating this law are liable to the same penalties as provided in the laws given above]

CHAPTER CCX. LAWS OF 1891.

A SUPPLEMENT to an act entitled "An act to prevent the adulteration and to regulate the sale of milk," approved March fourteenth, one thousand eight hundred and eighty two

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That when any inspector or his deputy, acting under the act to which this is a supplement, shall take any sample of milk for analysis, he shall divide said sample into two parts, shall duly seal each part in a suitable can, vessel or package ; shall tender and, if accepted, deliver, at the time of such taking, one part to the vender of said milk, or to the person having the custody of the same, with a statement in writing of the cause of the sample having been taken.

2. *And be it enacted*, That in all prosecutions under the act to which this is a supplement, the defendant may at the trial produce competent evidence to show the percentage of milk solids contained in the sample delivered to him, or to his agent or servant, as provided in section one thereof.

3. *And be it enacted*, That in all prosecutions under the act to which this is a supplement, where the violation charged is the addition of water or any other substance or thing, the defendant may at the trial produce competent evidence to show that the same has not been altered or adulterated.

4. *And be it enacted*, That all acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Laws Relating to the Adulteration of Food and Drugs.

AN ACT to prevent the adulteration of food or drugs.

[NOTE.– Sec. 1 amended by supplement which is given below.]

2. *And be it enacted*, That the term "food," as used in this act, shall include every article used for food or drink by man, and that the term "drugs," as used in this act, shall include all medicines for internal or external use.

3. *And be it enacted*, That any articles shall be deemed to be adulterated, within the meaning of this act:

(*a*) IN THE CASE OF DRUGS.

First If when sold under or by a name recognized in the United States pharmacopœia, it differs from the standard of strength, quality or purity laid down therein;

Second. If when sold under or by a name not recognized in the United States pharmacopœia, but which is found in some other pharmacopœia, or other standard work on materia medica, it differs materially from the standard of strength, quality, or purity laid down in such work;

Third. If its strength or purity fall below the professed standard under which it is sold.

(*b*) IN THE CASE OF FOOD OR DRINK.

First. If any substance or substances has or have been mixed with it, so as to reduce or lower, or injuriously affect its quality or strength;

Second. If any inferior or cheaper substance or substances have been substituted wholly or in part for the article;

Third If any valuable constituent of the article has been wholly or in part abstracted;

Fourth. If it be an imitation of or be sold under the name of another article;

Fifth. If it consist wholly or in part of a diseased or decomposed or putrid or rotten animal or vegetable substance, whether manufactured or not; or in case of milk, if it is the product of a diseased animal;

Sixth If it be colored or coated, or polished, or powdered, whereby damage is concealed, or it is made to appear better than it really is, or of greater value;

Seventh. If it contain any added poisonous ingredient or any ingredient which may render such article injurious to the health of a person consuming it; *provided*, that the state board of health may, with the approval of the governor, from time to time declare certain articles or preparations to be exempt from the provisions of this act; *and provided further*, that the provisions of this act shall not apply to mixtures or compounds recognized as ordinary articles of food, provided that the same are not injurious to health and that the articles are distinctly labeled as a mixture.

4. *And be it enacted*, That the state board of health shall, from time to time, fix the limits of variability permissible in any article of food, or drug or compound, the standard of which is not established by any national pharmacopœia.

[NOTE.—Sec. 5 amended by supplement.]

6. *And be it enacted*, That every person selling, or offering or exposing any article of food or drugs for sale, or delivering any article to purchasers, shall be bound to serve or supply any inspector appointed under this act, who shall apply to him for that purpose, and on his tendering the value of the same for a sample sufficient for the purpose of analysis of any article which is included in this act, and which is in the possession of the person selling, under a penalty not exceeding fifty dollars for a first offense, and one hundred dollars for a second and subsequent offense.

[NOTE.—Sec. 7 amended by supplement]

8. *And be it enacted*, That any acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Approved March 25th, 1881.

A SUPPLEMENT to an act entitled "An act to prevent the adulteration of food or drugs," approved March twenty-fifth, one thousand eight hundred and eighty-one.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That section one of the act to which this is a supplement be amended so as to read as follows:

[1. *And be it enacted* by the Senate and General Assembly of the State of New Jersey, That no person shall manufacture, have, offer for sale or sell any article of food or drugs which is adulterated within the meaning of this act, and any person violating any of the provisions of this act shall be liable to a penalty of fifty dollars for a first offense and one hundred dollars for a second or any subsequent offense.]

2. *And be it enacted*, That section five of the act to which this is a supplement be amended so as to read as follows:

[5. *And be it enacted*, That the state board shall take cognizance of the interest of the public health as it relates to the sale of foods and drugs, and the adulteration of the same and make all necessary inquiries and investigations relating thereto; it shall also have the appointment and supervision of public analysts and chemists or inspectors to serve for general service, or for such special service or length of time as it may deem necessary; and the board of health shall, from time to time, meet and adopt such measures as it may deem necessary for the enforcement of this act, and of the act to which it is a supplement, and prepare rules and regulations with regard to the proper method of collecting and examining articles of food or drugs; and the analysts, chemists or inspectors appointed may act singly or as associated in a council for such time as may be approved or authorized by said board.]

3. *And be it enacted*, That section seven of the act to which this is a supplement be amended so as to read as follows:

[7. *And be it enacted*, That any person violating any of the provisons of this act, and any person who shall hinder, impede, obstruct or otherwise prevent any analyst, inspector or prosecuting officer, in the performance of his duty, shall be liable to a penalty of fifty dollars for the first offense, and one hundred dollars for a second or subsequent offense.]

4. *And be it enacted*, That every district court in any city, and every justice of the peace in any county, and any police justice or recorder in any city, is hereby empowered, on oath or affirmation made according to law, that any person or persons has or have violated any provision of the act to which this is a supplement, to issue pr cess at the suit of any person, either in the manner of a summons or warrant, against the person or persons so charged, which process shall, when in the nature of a warrant, be returnable forthwith, and when in the nature of a summons, shall be returnable in not less than one nor more than ten entire days; such process shall state what provision of the law is alleged to have been violated by the defendant or defendants; and on the return of such process at any time to which the trial shall have been adjourned, the said court, justice of the peace, police justice or recorder, shall proceed to hear testimony and to determine and give judgment in the matter, without the filing of any pleadings; and the said court, justice of the peace, police justice or recorder shall, if judgment be rendered for the plaintiff, forthwith issue execution against the goods and chattels and person of the defendant or defendants; and the said court, justice of the peace, police justice or recorder is further empowered to cause any such defendant who may refuse or neglect to pay the amount of the judgment rendered against him and all the costs and charges incident thereto, unless an appeal is granted, to be committed to the county jail for any period not exceeding ninety days; but no district court of any city, justice of the peace, police justice or recorder shall have jurisdiction of any offense against the act to which this is a supplement which offense shall take place outside of the territorial jurisdiction of such district court, justice of the peace, police justice or recorder, as such territorial jurisdiction is now established by law.

5. *And be it enacted*, That the officers to serve and execute all process under this act shall be the officers authorized to serve and execute process in said courts, and before such magistrates and officers as aforesaid, including the constables of such counties and all police officers of such cities.

6. *And be it enacted*, That all penalties imposed under the act to which this is a supplement shall be disposed of as follows: In case the suit is brought by any officer appointed by the state board of health, the penalty shall be paid into the treasury of this state; in case the suit is brought by an officer of any local board of health of any city, borough, town or township, the penalty shall be paid into the treasury of said local board of health, city, borough, town or township; in case of any suit not otherwise provided for, the penalty shall be paid to the person bringing the suit.

7. *And be it enacted*, That the state board of health shall be authorized to expend annually, in addition to all sums already appropriated for such board, an amount not exceeding one thousand dollars for the purpose of including in its work the carrying out of the provisions of this act and for the protection of the public health.

8. *And be it enacted*, That any analyst or inspector appointed by the state board of health, and any inspector or other officer of any local board of health, shall have power to inspect any article of food or drugs, wherever exposed for sale, or offered or held for sale, or whether in transit or otherwise; and if, upon inspection of such food or drugs, the same shall be found adulterated within the meaning of this act, or the act to which this act is a supplement, the said inspector or other officers aforesaid shall have power and may prohibit the sale or disposal of said articles until decision shall be rendered by the court, justice of the peace, recorder, or police justice before whom the defendant may be brought.

9. *And be it enacted*. That this act shall not be so construed as to interfere with the special provisions of an act approved March fourth, eighteen hundred and eighty-two, entitled "An act to prevent the adulteration and to regulate the sale of milk."

10. *And be it enacted*, That this act shall take effect immediately.

Approved March 23d, 1883.

CHAPTER CXXVI. LAWS OF 1887.

A SUPPLEMENT to an act entitled "An act to prevent the adulteration of food or drugs," approved March twenty fifth, one thousand eight hundred and eighty-one.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That the state dairy commissioner is hereby directed and empowered to aid in the enforcement of the provisions of the act to which this is a supplement; and said commissioner and his assistants duly

commissioned shall be and are hereby made inspectors under the act to which this act is a supplement; the expense of enforcing said act shall be paid out of the appropriation already made for the use of said dairy commissioner for the enforcement of the act of March twenty-second, one thousand eight hundred and eighty six, entitled "An act to prevent deception in the sale of oleomargarine, butterine, or any imitation of dairy products, and to preserve the public health."

2. *And be it enacted,* That this act shall take effect immediately.

Approved April 11th, 1887.

Law Relating to Contagious and Infectious Diseases of Animals.

SUPPLEMENT to an act entitled "An act concerning contagious and infectious diseases among animals, and to repeal certain acts relating thereto," approved April fourth, one thousand eight hundred and eighty-six.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That the local board of health of any city of this state shall by ordinance require from time to time, a registry of all cattle kept within the limits of said city, which registry shall state the place of keeping, the number in each case kept, and the number of these intended, or used as milch cows; and it shall be the duty of the owner of any such cattle to make registry thereof at the time, place and in the manner that the board of health of said city may direct, under a penalty not exceeding fifty dollars for any neglect of the same; *provided*, that no such registry shall be made by any board of health until after the examination of the stables and place in which said cattle are kept, and until it is known to the satisfaction of said board that they are in good sanitary condition.

2. *And be it enacted*, That whenever any local board of health of any city shall have reason to suspect the existence of any contagious disease among cattle, or such as may be a risk or danger to the food or milk supply, or whenever they may deem it necessary, in order to prevent the occurrence of such risk or danger, they shall order the inspection of all cattle that are kept or intended for meat or milk production, by a competent veterinarian chosen by them, and may for such inspection require so much payment for such service as may be necessary for the expense attending such inspection; *it being, however, provided*, that in no case shall the amount charged exceed fifty cents a head per year for dairies of ten cows or under, and for all dairies above ten cows, twenty-five cents per head per year; *provided further*, that no charge shall be made against any one keeping a single cow for family use.

3. *And be it enacted*, That whenever any local board of health, or any veterinary inspector appointed by said board shall find or suspect any disease in any cow, or in any herd of milk-producing cattle, which may prove harmful to the meat or milk supply, the state board of health and the state dairy commissioner shall be notified, and it shall be the duty of the dairy commissioner to investigate the same, and he shall prohibit the sale or use of the milk from any milch cow, but he, or the owner of said

milch cow, may ask, through the state board of health, a report from some veterinarian appointed by the state board of health as to whether or how long, it will be necessary to continue the prohibition of the use of said milk, and the dairy commissioner or the state board of health may prohibit the use of said milk or of meat of any animal declared by a veterinarian of the state board to be unfit for use.

4. *And be it enacted*, That this act shall take effect immediately.

Approved March 16th, 1893.

CHAPTER CCCXVII. LAWS OF 1894.

A SUPPLEMENT to an act entitled "An act concerning contagious and infectious disease among animals and to repeal certain acts relating thereto," approved May fourth, one thousand eight hundred and eighty-six.

WHEREAS, it is said that tuberculosis in cattle prevails in some sections of this state, whereby the health of some of our citizens is imperiled; therefore,

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That the president of the state board of agriculture shall appoint five persons, citizens and taxpayers of this state, who, together with himself and the secretary of the state board of agriculture, shall constitute a commission who shall, at the request of two members of the state board of health or the state dairy commissioner or any owner of suspected animals, investigate the existence of tuberculosis, or cause the same to be investigated, and if any such disease is found to exist, to enforce such regulations in relation to the same as the said commission may adopt.

2. *And be it enacted*, That when any animal or animals shall be slaughtered by direction of said commission, the value of the same shall be ascertained and appraised by three disinterested freeholders, resident in this state, who shall make and sign certificates thereof in the presence of a witness who shall attest the same; such appraisement shall be made on the basis of the market value of the animal or animals slaughtered, just prior to the time when they became so diseased, and shall be limited to the sum of one hundred dollars for registered animals and to forty dollars to all others; one-half of the valuation so ascertained shall be paid by the state on the presentation of such certificate, with the approval of the said commission indorsed thereon, to the owner or owners.

3. *And be it enacted*, That it shall be the duty of said commission to keep a full and complete record of all their proceedings under this act, and report the same annually to the state board of agriculture, and such a report shall be printed in and form a part of the annual report of the state board of agriculture.

4. *And be it enacted*, That the sum of five thousand dollars is hereby annually appropriated to said commission to defray its expenses and the value of the cattle to be slaughtered by its direction; *provided*, that no

other compensation shall be allowed said commission than the expenses actually incurred in the execution of the duties hereby imposed.

5. *And be it enacted*, That all bills for money expended under this act shall be audited by the comptroller of this state and then submitted to the governor for his approval, and after being thus audited and approved by the governor shall be paid by the state treasurer upon the warrant of the comptroller.

6. *And be it enacted*, That this act shall be deemed a public act and shall take effect immediately.

Approved May 22d, 1894.

TABLE OF CONTENTS.

TABLE OF CONTENTS.

PAGE.

Report of the Commissioner, ... 3

Milk, ... 13

Table showing number of Milk Samples collected in each County, ... 14

Bovine Tuberculosis, ... 19

Creameries, ... 27

Oleomargarine, ... 5

Food, ... 31

Report of Shippen Wallace, Chemist, ... 33

Epidemic of Typhoid Fever at Bay Head. By Wm. Katzenbach, M.D., 39

Report of Prof. Albert R. Leeds, Ph.D., on Dairying in its Relation to the Inspection of Milk, ... 43

Laws Relating to the Adulteration of Food and Drugs, ... 119

Laws Relating to Contagious and Infectious Diseases of Animals, . 125

REPORT

ON THE

QUALITY OF THE MILK SUPPLY

OF THE

METROPOLITAN DISTRICT.

BY

C. F. CHANDLER, PH. D.,

PROFESSOR OF ANALYTICAL AND APPLIED CHEMISTRY, SCHOOL OF MINES, COLUMBIA COLLEGE.

[*EXTRACT FROM THE FOURTH ANNUAL REPORT OF THE METROPOLITAN BOARD OF HEALTH.*]

NEW YORK:
D. APPLETON & COMPANY,
90, 92 & 94 GRAND STREET.
1870.

REPORT ON THE QUALITY OF THE MILK-SUPPLY DURING THE YEAR 1869.

COLONEL EMMONS CLARK, *Secretary of the Metropolitan Board of Health.*

SIR: The investigations with regard to the quality of the milk-supply in the Metropolitan District, which were undertaken at the suggestion of Dr. Harris, the Sanitary Superintendent, have been continued during the past year, and I announce with great satisfaction that thus far no adulterant has been detected except water.

I.—PURE MILK.

Milk consists of water holding *in solution* casein or cheese, lactine or sugar of milk, and various alkaline and earthy salts; and *in suspension*, fatty matter, butter, in the form of myriads of semi-opaque globules, to which the color and opacity of milk are due.

1. *The Average Composition of Pure Milk, according to Dr. Letheby, is:*

Water	86.00
Butter	3.90
Casein	4.10
Sugar	5.20
Salts	0.80
	100.00

2. *Complete Analysis of Milk by Haidlen.*

Water	87.30
Butter	3.00
Casein	4.82
Sugar	4.39
Phosphate of Lime	0.230
Phosphate of Magnesia	0.042
Phosphate of Iron	0.007
Chloride of Potassium	0.144
Chloride of Sodium	0.024
Soda, combined with Casein	0.042
	100.00

The specific gravity varies from 1.023 to 1.032, pure water being 1.000 The reaction is generally faintly alkaline.

The composition of milk is, however, affected by a variety of circumstances, as the breed of the cow, her age, the age of her calf, nature of her food, time of milking, frequency of milking; and it is even found that the last milk which comes down at a milking is richer in butter than that which is first drawn. This last-mentioned fact shows that the custom which prevails in some localities of driving the cow from house to house, and supplying the consumer with milk fresh from the udders is not quite equitable, as the last person supplied receives a richer milk than is given to the first customer.

The following analyses illustrate these statements:

3. *Milk from Different Breeds of Cows. Analyses by Vernois et Becquerel.*

Breed.	Water.	Butter.	Casein.	Sugar.	Salts.
Angus	80.32	9.88	5.28	3.73	0.72
Belgian—Durham	85.77	6.22	4.06	3.29	0.67
Bohemian	84.18	6.34	3.87	4.96	0.64
Bretonne	83.74	5.70	5.37	4.55	0.62
Charollais	85.28	6.42	4.12	3.49	0.68
Durham, two analyses	84.56	6.41	4.37	3.97	0.68
Flamande	88.30	3.72	3.37	4.03	0.54
Dutch, three analyses	83.97	6.84	4.21	4.35	0.61
Murzthal	85.31	6.28	3.14	4.62	0.64
Normandy	87.18	3.24	4.76	4.21	0.60
Paris, thirty analyses	86.40	3.61	5.21	4.10	0.66
Swiss	85.19	7.08	2.55	4.59	0.56
Tyrol	81.74	7.96	4.95	4.82	0.50
Voigtland	84.99	5.14	4.56	4.62	0.68
Average, 46 analyses	85.76	4.51	4.86	4.15	0.65

4. *Effect of Food on the Quality of Milk. Analyses by Chevalier.*

	Carrots.	Beets.
Water	86.67	86.87
Butter	3.08	2.75
Casein	4.20	3.75
Sugar	5.30	5.95
Salts	0.75	0.68
	100.00	100.00

5. *Difference in Morning and Evening Milk. Averages of many Analyses by Alex. Müller.*

	Morning.	Evening.
Water	87.43	86.87
Butter	3.77	4.32
Casein	3.40	3.44
Sugar	4.67	4.66
Salts	0.73	0.71
	100.00	100.00

Methods of Analysis.

1. The water is determined by evaporating a weighed quantity of milk, either alone or soaked up in a known weight of pure, fine quartz sand. The residue is carefully dried at 212° F., and weighed. The loss in weight represents the water, while the residue includes all the solid constituents.

2. The salts are determined by carefully burning off the combustible portion

of the solid residue obtained by evaporation, and weighing the incombustible ash.

3. The butter and casein are determined by coagulating the milk with a few drops of acetic acid, boiling, washing the precipitate with water, and finally separating the butter with ether, leaving the casein pure. On evaporating the ether, the butter is left behind, or the butter may be extracted by ether from the residue obtained by the evaporation of a quantity of milk, soaked up in sand.

4. The sugar is generally determined by deducting the sum of the other constituents from 100. It may be directly determined by the polariscope, after the removal of the casein and butter, or it may be determined by an alkaline solution of copper.

II.—THE ADULTERATION OF MILK.

Numerous substances are mentioned as having been used, or as supposed to be used, for adulterating milk. Prominent among these are:

1. *Water.*—Adulteration with this substance is generally detected by the specific gravity of the milk. Pure milk varies in specific gravity from 1.023 to 1.034, water being represented by 1.000. Milk is heavier than water, on account of the casein, sugar, and salts, which it holds in solution. Butter, on the other hand, is lighter than water, therefore the specific gravity of milk increases with the percentage of casein, sugar, and salts, while it diminishes with the percentages of water or butter. It is found that good milk generally has a specific gravity of from 1.029 to 1.032. In testing milk the lower number is selected as a fair gravity for pure milk; and whenever the gravity falls below this number the milk may be considered as containing an excess of water, and consequently poor in quality or adulterated. An instrument, called a galactometer, has been devised by Dinocourt, for the purpose of testing the quality of milk. It is simply an areometer, so graduated that 100 on the scale represents pure milk, or the gravity 1.029, while 0 represents pure water or gravity 1.000, the space between being divided into 100 parts. The numbers on the scale represent, therefore, the percentages of pure milk.

Skimmed milk, having been deprived of most of its butter, is heavier than whole milk. By skimming the milk before testing it with the galactometer, the error caused by the butter is eliminated. In this case, however, the mark for 100, or pure milk, must be placed lower down on the instrument, as pure milk, having a specific gravity of 1.029, would after being skimmed, have a gravity of about 1.033. The 100° mark for skimmed milk is, therefore, fixed at this point.

The *lactometer* is a simple tube closed at the lower end, and graduated in hundredths. It is designed to measure the quantity of cream which rises on the milk.

By using the two instruments together, the *galactometer* and the *lactometer*, very satisfactory conclusions with regard to the quality of milk can be formed. A perfectly reliable method, though more laborious, is to actually determine the percentage of water in the milk, by evaporating a weighed quantity, and carefully drying the residue at 212° F. If a milk loses more than 88 per cent. of water, having less than 12 per cent. of solids, it may be safely pronounced to be adulterated with water.

2. *Chalk.*—This substance is generally supposed to be extensively used to neutralize the acidity in soured milk, and to produce thickness and opacity, thus concealing dilution with water. It is easily detected, as it is deposited on standing, and can then be recognized by its effervescing with dilute acids. I have never detected it in any sample of milk examined. Its presence would also be shown in a milk analysis, by the unusual amount of ash.

3. *Flour, starch, emulsions of almonds, or hemp-seed, etc.*, are said to be used to thicken milk, and neutralize the blue color caused by dilution. They were not found in any of our samples.

4. *Sugar, gum, dextrin and borax*, to increase specific gravity.

5. *Turmeric and annatto*, to hide the blue color.

6. *Cerebral matter, sheep's brains*, to thicken watered milk, easily detected by the microscope, and by its depositing a peculiar white sediment on standing.

7. *Carbonate or bicarbonate of soda*, to neutralize acidity. Detected by the increase in the quantity of ash, or better by the effervescence of the ash with acids.

III.—THE MILK SUPPLIED TO CONSUMERS IN THE METROPOLITAN DISTRICT

Two hundred and ninety-seven specimens of the milk supplied to consumers in the Metropolitan District have been submitted to chemical examination. Of these forty-five were seized while undergoing the process of dilution with water, two hundred and forty-five were purchased from the retail dealers, and seven were procured at one of the crowded cow-stables in Brooklyn.

First Series of Analyses.—In the latter part of February, some milkmen were detected in the act of pouring a suspicious fluid, contained in milk-cans, into their milk. They were at once arrested, and taken, with their cans, about fifty in number, to police headquarters. Samples from forty-five of the cans, which were placed in my hands for examination, gave the following results:

Two cans contained water, not any too pure.

Two cans contained water, clouded with a little milk, probably from having been pumped into cans which had contained milk.

Four cans contained water to which considerable milk had been added, the specific gravity varying from 1.010 to 1.017, representing by the galactometer from 37 to 60 per cent. of milk.

Nineteen cans contained milk, to which considerable water had been added, the specific gravity varying from 1.023 to 1.028, representing from 80 to 97 per cent. of milk.

Eighteen cans contained pure milk, varying in specific gravity from 1.029 to 1.030.

None of the samples contained any adulterant save water. The large proportion of pure milk is accounted for by the fact that the work of dilution was interrupted by the police.

Second Series of Analyses.—During the months of June and July a systematic examination of milk was organized, the samples being purchased from retail dealers in various portions of the Metropolitan District. Two hundred and ten samples were analyzed, the following determinations being made in each case :

1. The specific gravity.
2. The percentage of pure milk as shown by the galactometer.
3. The percentage of water.
4. The percentage of solid matter, including butter, casein, sugar of milk, saline constituents, etc.
5. Examination for adulterations.

The results are herewith presented in tabular form, and from them we learn the following facts :

1. The specific gravity varies from 1.010 to 1.032, averaging 1.0208.
2. The percentage of pure milk, as shown by the galactometer, ranges from 37 to 110, averaging 72½.
3. The percentage of water varies from 83.57 to 94.17, averaging 89.89.
4. The percentage of solid constituents, the nutritive portion of the milk, varies from 5.83 to 16.43 per cent., averaging 10.11
5. No adulteration was found in a single instance, save water.

Table I.—Milk Examinations during June and July, 1869.

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
—— McSwyny	497 Pearl Street			87.79	12.21
	14 Franklin	1.029	98	90.14	9.86
D. & A. Boseke	61 Baxter	1.029	98	82.42	17.58
Chas. Doscher	13 Mott	1.032	106	88.80	11.10
	71 Park Place	1.029	98	88.12	11.88
Wm. Moller & Son	524 Pearl	1.020	70	91.18	8.82
C. A. Emmet	21 Mott	1.025	86	89.68	10.32
Daniel Sullivan	67 Park Street	1.025	86	88.33	11.67
D. Driscoll	24 City Hall Place	1.020	70	89.00	11.00
Mrs. Horsey	136 Leonard	1.020	70	88.11	11.89
Galligban Bros	119 Mulberry	1.025	86	87.84	12.16
J. J. Geaby	22 Mulberry	1.025	86	89.41	10.59
Schreider & Wilken	115 Baxter	1.025	86	86.17	13.83
J. Dellart	40 Eldridge	1.025	86	85.22	14.78
J. Seeldy	36 Park	1.022	76	86.71	13.29
—— McSwyny	497 Pearl	1.022	76	82.97	17.03
A. Knauer	79 Broome	1.025	86	88.72	11.28
C. W. Dainty	234 Worth	1.025	86	88.38	11.62
H. Pentz	119 Baxter	1.025	86	89.41	10.59
A. Horr	263 Rivington	1.020	70	90.09	9.91
J. F. McDowell	92 Henry	1.026	90	87.72	12.28
F. McKenne	34 Pitt	1.025	86	90.15	9.85
J. McKulloch	Laurel Hill	1.018	63	90.81	9.19
G. Kasselmine	72 Garrick	1.020	70	88.26	11.74
J. McDonald	103 Broome	1.022	76	88.76	11.24
A. Schulingburg	169 Allen	1.025	86	89.01	10.99
J. Wittman	131 E. Houston	1.026	90	88.42	11.58
J. Watjen	34 2d Avenue	1.020	70	89.11	10.89
W. Doyle	79 Ludlow	1.025	86	90.89	9.11
G. Bachmann	51 Ludlow	1.020	70	88.85	11.15
J. Raedig	106 Allen	1.023	80	89.51	10.49
J. M. Oest & Co.	16 2d Avenue	1.023	80	89.12	10.88
Peter Fick	230 6th Avenue	1.025	86	85.55	14.45
D. F. Reck	113 W. 10th	1.025	86	87.79	12.21
F. H. Rohers	58 6th Avenue	1.025	86	87.81	12.29
H. Piefke	18 6th Avenue	1.025	86	88.78	11.22
N. Bremer	4 6th Avenue	1.027	93	88.36	11.64
D. Hopmann	22 Minetta Lane	1.022	76	89.89	10.11

Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
Wm. Rame	26th Street and 7th Avenue	1.027	93	89.26	10.74
A. Lieberg	257 7th Avenue	1.025	86	87.93	12.07
Russing & Ebert	189 7th Avenue	....	....	87.43	12.57
J. McCrady	134½ 7th Avenue	1.025	86	87.46	12.54
Wm. J. Acker	21 7th Avenue	1.025	86	88.28	11.72
R. Devans	37 Greenwich Avenue	1.025	86	88.43	11.57
P. Steinmann	105 11th Avenue	1.028	96	87.63	12.37
J. W. Steinbeck	63d Street and 2d Avenue	1.025	86	87.57	12.43
Block & Co	337 54th Street	1.024	83	88.42	11.58
Hermann & Son	1024 2d Avenue	1.022	76	89.18	10.82
—— Cunningham	1008 2d Avenue	1.020	70	89.27	10.73
C. M. Cornell	Astoria	1.020	70	90.14	9.86
—— Futhius	223 E. 53d Street	1.023	80	90.37	9.63
P. Brady	45th Street and Madison Ave.	1.027	93	86.27	13.73
—— McNeal	46th Street and 4th Avenue	1.025	86	83.57	16.43
H. Hallan	338 E. 58th Street	1.020	70	88.90	11.10
E. Thomas	207 E. 36th Street	1.025	86	87.22	12.78
P. Mallach	589 2d Avenue	1.024	83	87.78	12.22
M. Snider	61st Street near 2d Avenue	1.012	44	....	....
G. Hammer	57th Street near 5th Avenue	1.025	86	....	....
J. B. Murry	57th Street and 7th Avenue	1.020	70	88.27	11.73
B. Schwietering	813 7th Avenue	1.023	80	88.90	11.10
—— Mills	790 7th Avenue	1.025	86	88.27	11.73
—— Dillinger	412 W. 50th Street	1.027	93	88.64	11.36
J. Bohde	824 2d Avenue	1.025	86	89.60	10.40
C. H. Steinkamm	863 2d Avenue	1.023	80	88.10	11.90
F. Buse	765 2d Avenue	1.020	70	90.25	9.75
Powell & Co	681 2d Avenue	1.022	76	89.62	10.38
H. Claussen	648 2d Avenue	1.027	93	88.74	11.26
F. Kriete	82 7th Avenue	1.019	66	91.25	8.75
Bussing & Ebert	189 7th Avenue	1.022	76	88.98	11.02
P. L. Hulle	721 9th Avenue	1.020	70	90.85	9.15
P. Brahnburg	683 9th Avenue	1.023	80	89.36	10.64
—— Bucklage	628 9th Avenue	1.018	63	90.02	9.98
—— Maxwell	558 9th Avenue	1.018	63	90.82	9.18
J. Bernhard	469 9th Avenue	1.025	86	88.47	11.53
R. Doty	315 9th Avenue	1.018	63	92.04	7.96
Browning & Berry	183 9th Avenue	1.025	86	88.33	11.67
Wessel & Puckley	2 9th Avenue	1.025	86	88.79	11.21
H. H. Krogan	518 10th Avenue	1.020	70	89.73	10.27
—— Fight	500 10th Avenue	1.012	44	93.25	6.75
M. Schnied	368 10th Avenue	1.017	60	90.31	9.69
D. Hunkey	327 10th Avenue	1.018	63	90.70	9.30
E. Ryan	263 10th Avenue	1.018	63	91.00	9.00
—— Hunker	242 10th Avenue	1.023	80	91.54	8.46
J. O. Sullivan	153 10th Avenue	1.013	47	92.26	7.74
J. Ruter	770 Greenwich	1.014	50	91.41	8.59
P. Hohre	744 11th Avenue	1.015	53	92.32	7.68
—— Murray	673 4th Avenue	1.021	73	91.07	8.93
P. Swick	609 10th Avenue	1.017	60	91.16	8.84
—— Plunket	517 10th Avenue	1.031	103	85.47	14.53
A. Marquart	422 10th Avenue	1.024	83	90.22	9.78
P. O. Sullivan	153 10th Avenue	1.015	53	92.39	7.61
Austin Yearks	118 9th Avenue	1.022	76	89.92	10.08
F. Panaxtre	160 8th Avenue	1.016	56	91.61	8.39
John Maurer	997 1st Avenue	1.023	80	89.73	10.27
H. Berns	839 1st Avenue	1.021	73	91.02	8.98
H. Rick	815 1st Avenue	1.017	60	91.47	8.53
C. H. Katter	547 1st Avenue	1.016	56	91.99	8.01
H. D. Bruns	445 1st Avenue	1.020	70	91.36	8.64
P. D. Cordes	429 1st Avenue	1.017	60	90.58	9.42
John M. Oest	383 1st Avenue	1.020	70	90.60	9.40
F. Purdy	319 1st Avenue	1.020	70	90.21	9.79
John Spielmann	222 1st Avenue	1.015	53	91.64	8.36
—— Oppenheimer	201 1st Avenue	1.020	70	90.29	9.71
Henry Klenke	146 1st Avenue	1.020	70	90.43	9.57
D. Klenke	115 1st Avenue	1.019	66	90.54	9.46
A. Schulz	96 1st Avenue	1.023	80	90.70	9.30
David Roemer	60 1st Avenue	1.015	53	91.72	8.28
Henry Malsey	26 1st Avenue	1.015	53	92.09	7.91
A. Schulte	11 1st Avenue	1.018	63	90.80	9.20
John Thiel	207 Avenue A	1.015	53	91.93	8.07
Chas. Mincum	147 Avenue A	1.017	60	91.20	8.80
F. Ebenger	149 Avenue A	1.015	53	92.03	7.97
John Hoopner	41 Avenue A	1.018	63	93.08	6.92

Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
H. & P. Theil	22 Avenue A	1.012	44	92.61	7.39
Mrs. Surman	175 Suffolk	1.018	63	91.14	8.86
Henry Bartell	16 Suffolk	1.020	70	90.70	9.30
—— Behyl	166 Avenue B	1.014	50	92.26	7.74
Meyer & Co.	94 Avenue B	1.018	63	91.48	8.52
—— Corkersburg	64 Avenue B	1.020	70	89.70	10.30
Christ. Siles	32 Avenue B	1.015	53	92.77	7.23
Peter Bäker	11 Avenue B	1.020	70	92.76	7.24
P. Ahleim	203 Avenue C	1.014	50	92.60	7.40
John Ricken	174 Avenue C	1.014	50	92.92	7.08
	107 Avenue C	1.015	53	91.46	8.54
Riese & Brother	69 Avenue C	1.015	53	92.04	7.96
Will. Barkler	14 Avenue C	1.015	53	92.31	7.69
J. Cabbenger	6 Avenue C	1.012	44	94.17	5.83
John Holsten	79 Pitt	1.015	53	93.43	6.57
Peter Kooney	54 Pitt	1.015	53	91.80	8.20
H. Kinkan	74 Avenue D	1.015	53	91.80	8.20
F. Brohel	22 Avenue D	1.015	53	92.35	7.65
A. Moeller	16 Avenue D	1.010	37	93.41	6.59
P. Schmidt	101 Columbia	1.013	47	91.85	8.15
Otto H. Coop	74 Columbia	1.020	70	88.98	11.02
Will. Katgin	365 3d Avenue	1.010	37	93.03	6.97
H. Devender	245 3d Avenue	1.012	44	93.08	6.92
L. Balor	415 3d Avenue	1.013	47	92.29	7.71
C. Fisher	478 3d Avenue	1.015	53	90.82	9.18
J. G. Gerdes	557 3d Avenue	1.013	47	91.95	8.05
D. H. Schulz	605 3d Avenue	1.015	53	91.13	8.87
G. E. Wehmann	40 Franklin	1.015	53	91.00	9.00
H. F. Cordes	39 Elm	1.019	66	90.35	9.65
H. Tienchen	66 W. Broadway	1.015	53	91.40	8.60
H. F. Newman	7 Harnson	1.025	86	89.73	10.27
Ph. Fewring	93 Elm	1.018	63	89.31	10.69
W. Smith	165 Avenue A	1.028	96	88.53	11.47
F. Intemann	353 Greenwich	1.022	76	88.87	11.13
—— Newrenberg	1 Lispenard	1.026	90	89.10	10.90
L. Walker	139 W. Broadway	1.022	76	90.08	9.92
D. Stowesand	97 W. Broadway	1.026	90	89.10	10.90
—— Wisschusen	16 York	1.022	76	90.08	9.92
John Moss	33 Leonard	1.025	86	88.80	11.20
J. Balch	133 Greenwich	1.022	76	90.68	9.32
M. Hertily	26 Rector	1.024	83	89.32	10.68
J. P. Koplic	145 Greenwich	1.025	86	88.00	12.00
C. Maerbeck	135 Liberty	1.024	83	88.63	11.37
P. Flynn	151 Washington	1.025	86	88.02	11.98
G. F. Broggensen	91 Greenwich	1.020	70	90.77	9.23
J. McDonald	19 Albany	1.022	76	89.30	10.70
—— Wette	Carlisle and Washington	1.025	86	89.84	10.16
D. McCarthey	8 Morris	1.020	70	90.33	9.67
K. E. Enright	12 Greenwich	1.021	73	91.29	8.71
J. H. Gentzen	28 Greenwich	1.024	83	88.40	11.60
M. Henken	40 Greenwich	1.023	80	87.80	12.20
M. Kelly	4 Morris	1.016	56	91.54	8.46
Michael Landy	29 Washington	1.020	70	89.87	10.13
Michael O'Connor	71 Washington	1.015	53	91.56	8.44
Philip Shelan	24 Morris	1.022	76	88.95	11.05
Mrs. Pritching	401 E. 18th Street	1.018	63	91.53	8.47
—— Jaggart	342 1st Avenue	1.021	73	88.53	11.47
J. M. Oest	303 1st Avenue	1.020	70	90.67	9.33
A. Spielmann	220 1st Avenue	1.020	70	89.84	10.16
C. Wolfart	275 1st Avenue	1.022	76	89.11	10.89
D. Leopold	402 2d Avenue	1.025	86	89.74	10.26
A. Kneble	318 E. 22d Street	1.020	70	89.42	10.58
J. C. Reisen	407 E. 19th Street	1.018	63	90.01	9.99
L. Remshardt	206 Avenue A	1.024	83	88.93	11.07
Patrick O'Connor	224 Avenue A	1.021	73	90.28	9.72
J. Pentar	512 E. 15th Street	1.023	80	89.18	10.82
J. Haukamp	227 E. 21st Street	1.024	83	88.97	11.03
E. Wehrenberg	361 2d Avenue	1.020	70	89.53	10.47
P. W. Sanders & Co.	258 Avenue A	1.024	83	88.07	11.93
C. F. Wilken	273 Avenue A	1.023	80	89.11	10.89
J. Priede	323 Avenue A	1.015	53	90.51	9.49
Peter Peterson	231 Avenue B	1.019	66	90.18	9.82
F. Fippinger	546 E. 11th Street	1.020	70	89.10	10.90
J. Beek	509 E. 11th Street	1.018	63	90.47	9.53
F. Ebinger	149 Avenue A	1.016	56	89.99	10.01

Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
H. Wesemans	286 E. 10th Street	1.020	70	89.71	10.29
P. Lahr	341 E. 10th Street	1.023	80	88.45	11.55
H. A. Stegeman	352 E. 10th Street	1.017	60	90.41	9.59
A. Ritz	191 E. 7th Street	1.020	70	88.47	11.53
William Reis	410 E. 6th Street	1.021	73	89.71	10.29
M. Moser	433 E. 6th Street	1.023	80	89.92	10.08
C. Hartungs	437 E. 6th Street	1.025	86	89.28	10.72
C. D. Schupp	502 E. 6th Street	1.023	80	90.07	9.93
Geo. Siemon	507 E. 6th Street	1.021	73	90.00	10.00
C. Hitzel	520 E. 5th Street	1.024	83	89.07	10.93
F. Lautenschleuger	203 E. 4th Street	1.021	73	89.66	10.34
J. Schultz	154 E. 4th Street	1.024	83	89.48	10.52
J. Heubner	41 Avenue A	1.021	73	90.21	9.79
Geo. Finkles	102 E. 3d Street	1.022	76	90.41	9.59
J. Weber	193 E. 3d Street	1.024	83	88.59	11.41
Chris. Silz	32 Avenue B	1.023	80	89.79	10.21
L. A. Betsch	166 E. 3d Street	1.025	86	89.48	10.52
G. Deible	212 E. 3d Street	1.024	83	89.49	10.51
A. Reichert	152 E. 3d Street	1.021	73	90.78	9.22
J. Lang	5 Clinton Street	1.024	83	89.53	10.47
Average		1.0208	72.45	89.89	10.11

Third Series of Analyses.—During the last four months of the year, a series of more elaborate analyses was undertaken, with a view to determine the percentages of some of the individual constituents of the milk. Thirty-five samples were examined, and the results, which are herewith presented in tabular form, establish the fact that—

1. The cream averaged 7.89 per cent., ranging from 5.20 to 11.80 per cent.
2. The percentage of pure milk, as shown by the galactometer, averaged 82.44, varying from 50 to 112.
3. The butter averaged 3.03 per cent., varying from 1.81 to 3.76.
4. The casein and milk-sugar together averaged 6.46 per cent., ranging from 4.16 to 9.02.
5. The saline and earthy constituents averaged 0.59 per cent., varying from 0.39 to 0.87 per cent.
6. The total solids averaged 10.08 per cent., ranging from 6.73 to 12.32 per cent.
7. The water averaged 89.92 per cent., ranging from 87.68 to 93.27 per cent.
8. No adulteration was found in any case save water.

Table II.—Milk Examinations during the last Four Months of 1869.

DATE.	DEALER.	ADDRESS.	Reaction.	Cream.	Percentage of Milk by Galactometer.	Butter.	Casein and Sugar.	Salts.	Total Solids.	Water.
September 22	—— Thiel	20 Avenue A			72	2.68	6.12	0.57	9.37	90.63
“ 22	—— Roth	81 Avenue A			73	2.25	5.87	0.53	8.65	91.35
“ 22	—— Dorsch	122 E. 7th Street			64	2.62	4.91	0.57	8.10	91.90
“ 22	A. Ritler	223 Houston			66	2.09	5.74	0.53	8.36	91.64
“ 23		Rockland County		8.5	80	3.25	6.32	0.65	10.22	89.78
“ 24	Taylor's Saloon	355 Broadway		8.5	112	2.43	9.02	0.87	12.32	87.68
“ 27	C. A. Kelley	105 Avenue C		7.8	50	2.18	4.16	0.39	6.73	93.27
“ 27	Riesse Bros	69 Avenue C		6.8	68	2.67	5.57	0.51	8.75	91.25
“ 27	—— Barkley	14 Avenue C		6.6	71	2.26	5.97	0.52	8.75	91.25
“ 27	—— Jean	265 2d Street		6.6	75	2.82	5.84	0.59	9.25	90.75
October 4	—— Maloney	210 E. 6th Street		7.3	69	3.11	5.90	0.54	9.55	90.45
“ 4	—— Busch	213 E. 6th Street		6.2	87	3.05	6.76	0.71	10.52	89.48
“ 4	—— Lubkin	233 Bowery		5.2	79	2.91	6.68	0.62	10.21	89.79
“ 4	—— Sunken	20 Bleecker		5.3	86	1.81	7.26	0.66	9.73	90.27
“ 30	Jacob Stein	Mott and Spring	Neutral.	6.3	86	3.76	6.34	0.65	10.75	89.25
“ 30	A. Tienken	297 Mott	Sl. Acid.	7.8	85	2.24	7.35	0.64	10.23	89.77
“ 30	Henry Claus Fayen	73 E. Houston	Sl. Acid.	6.5	96	3.02	7.32	0.69	11.03	88.97
November 2	A. Hadden	236 E. 24th Street	Sl. Acid.	12.8	97					
“ 17	Michael McBride	194½ Greene	Sl. Acid.	8.6	72	3.21	6.43	0.50	10.14	89.86
“ 17	Mary Felicine	209 Greene	Sl. Acid.	8.3	86	3.32	7.16	0.63	11.11	88.89
“ 17	Marcus Martins	197 Greene	Sl. Acid.	6.1	78	3.01	6.24	0.59	9.84	90.16
“ 17	Henry Seeberck	157 Greene	Sl. Acid.	8.1	70	3.54	5.76	0.54	9.84	90.16
“ 27	Hermann Drewes	226 Chrystie	Sl. Acid.	8.3	100	3.69	7.49	0.67	11.85	88.15
“ 27	John Whittman	131 E. Houston	Sl. Acid.	8.0	95	3.12	7.77	0.63	11.52	88.4
“ 27	Albert Schulte	11 1st Avenue	Sl. Acid.	6.1	90	2.50	7.32	0.61	10.43	89.57
“ 27	John D. Schmidt	185 E. Houston	Sl. Acid.	9.8	90	2.87	8.10	0.62	11.59	88.41
December 11	William Kaltenbach	178 Essex	Sl. Acid.	8.9	97	3.21	7.37	0.63	11.21	88.79
“ 11	Hermann Pflug	175 Essex	Sl. Acid.	8.0	96	3.28	7.80	0.63	11.71	88.29
“ 11	John Geiss	160 Essex	Neutral.	9.8	82	3.34	6.56	0.52	10.42	89.58
“ 11	Christian Schaefer	129 Stanton	Acid.	9.9	88	3.02	6.76	0.58	10.36	89.64
“ 16	Michael Reinhardt	217 Stanton	Acid.	8.0	89	2.62	7.17	0.62	10.41	89.59
“ 16	Christian Kurtz	96 Willet	Sl. Acid.	9.3	72	2.87	5.83	0.47	9.17	90.83
“ 16	Philip Thomas	101 Willet	Sl. Acid.	6.1	100	3.26	7.74	0.67	11.67	88.33
“ 16	Jacob Weymar	118 Willet	Sl. Acid.	11.1	82	2.36	6.37	0.49	9.22	90.78
	Average			7.89	82.44	3.03	6.46	0.59	10.08	89.92

Fourth Series of Analyses.—During the month of April, the attention of the Board having been called to the crowded condition of some of the large cow-stables in the Metropolitan District, the Sanitary Superintendent, Dr. Harris, was directed to make an investigation. It was found on examination that, although the stables were over-crowded, dark, and damp, and deficient in ventilation, the animals generally presented a good appearance.

Seven samples of milk were collected and submitted to analysis, with the following results:

	Water.	Butter.	Casein and Sugar.	Salts.
No. 1	90.00	1.31	8.00	0.69
" 2	89.02	2.16	8.10	0.72
" 3	88.88	2.41	7.62	0.79
" 4	88.18	2.54	8.50	0.78
" 5	88.09	2.32	8.75	0.84
" 6	88.48	1.51	9.20	0.81
" 7	89.20	0.84	9.19	0.77
Average	88.85	1.87	8.48	0.77
Healthy Milk	86.00	3.90	9.30	0.80

It appears that the milk of these cows is specially deficient in butter, though it is in *every* respect poorer than the milk of healthy cows. No other indications of disease could be detected in the milk.

The blood of three of these cows was also analyzed, with the following results—the 4th column is an analysis of healthy blood:

	1.	2.	3.	4.
Water	799.81	801.35	843.12	779.06
Fibrin	4.91	5.94	7.63	4.39
Albumen	104.90	69.37	85.22	60.02
Corpuscles	81.10	101.13	51.33	146.50
Extractive	0.95	3.68	6.40	3.20
Soluble Salts	8.33	8.53	6.30	7.01
	1,000.00	1,000.00	1,000.00	1,000.00

The blood of the confined cows is strikingly deficient in red corpuscles, and contains from two to six per cent. more water than the healthy blood. It is thus seen that, while these cows present a fair appearance, they are not in a sound, healthy condition; and, though analysis may fail to detect any specific poison, such milk cannot be considered healthy food.

CONCLUSION.

This investigation establishes the fact that the citizens of the Metropolitan District are generally receiving milk which is free from injurious adulterations, and untainted with disease.

Nevertheless, a fraud is perpetrated upon them in the systematic dilution of the milk with water. The average percentage of pure milk in the adulterated article with which the city is supplied, is 73.28; or, in other words, for every three quarts of pure milk there is added one quart of water. It was stated at the Convention of Milk Producers and Dealers, held at Croton Falls, in March, 1870, that the total amount of milk supplied to the cities of New York and Brooklyn from the surrounding country was about 120,000,000 quarts per annum. To reduce this to the quality of our city supply, requires an addition of 40,000,000 quarts of water, which, at ten cents per quart, costs us the snug sum of $4,000,000 annually, or about $12,000 per day.

I have been aided in this investigation by W. H. Chandler, M. Alsberg, Ph. D., and H. Endemann, Ph. D.

Very respectfully, yours,
C. F. CHANDLER, Ph. D.,
Chemist to the Metropolitan Board of Health.

FIFTEENTH ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1899.

Part II of the Annual Report of the University of Maine.

FIFTEENTH ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO MAINE

PART II OF THE ANNUAL REPORT OF THE UNIVERSITY OF MAINE

AUGUSTA
KENNEBEC JOURNAL PRINT
1900

The Bulletins of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,
Orono, Maine.

STATE OF MAINE.

A. W. Harris, Sc. D., President of the University of Maine:

SIR:—I transmit herewith the Fifteenth Annual Report of the Maine Agricultural Experiment Station for the year ending December 31, 1899.

CHARLES D. WOODS,
Director.

ORONO, Maine, December 31, 1899.

MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE.

THE STATION COUNCIL.

President Abram W. Harris	*President*
Director Charles D. Woods	*Secretary*
Arthur L. Moore, Camden	*Committee of Board of Trustees*
Edward B. Winslow, Portland	
Voranus C. Coffin, Harrington	
B. Walker McKeen, Fryeburg	*State Board of Agriculture*
Otis Meader, Albion	*State Grange*
Charles S. Pope, Manchester	*State Pomological Society*
James M. Bartlett	*Members of the Station Staff*
Lucius H. Merrill	
Francis L. Harvey	
Fremont L. Russell	
Welton M. Munson	
Gilbert M. Gowell	

THE STATION STAFF.

The President of The University.

Charles D. Woods	*Director*
James M. Bartlett	*Chemist*
Lucius H. Merrill	*Chemist*
Francis L. Harvey	*Botanist and Entomologist*
Fremont L. Russell	*Veterinarian*
Welton M. Munson	*Horticulturist*
Gilbert M. Gowell	*Stock Breeding and Poultry*
Lucius J. Shepard	*Assistant in Agriculture*
Ora W. Knight	*Assistant Chemist*
Horace L. White *	*Assistant Chemist*
Edward R. Mansfield †	*Assistant Chemist*

---

* Resigned June 30, 1899.

† Appointed July 1, 1899.

TABLE OF CONTENTS.

	PAGE
Letter of transmittal	3
Officers of the Station	4
Announcements	7
Feeding Stuff Inspection (Bulletin 48)	9
Care of Orchards (Bulletin 49)	23
Fertilizer Inspection (Bulletin 50)	29
Feeding Stuff Inspection (Bulletin 51)	37
The Spraying of Plants (Bulletin 52)	51
Fertilizer Inspection (Bulletin 53)	57
Nuts as Food (Bulletin 54)	71
Cereal Breakfast Foods (Bulletin 55)	93
Apple Insects of Maine (Bulletin 56)	107
Experiments With Potatoes (Bulletin 57)	145
Acknowledgments (Bulletin 58)	159
Meteorological observations (Bulletin 58)	162
Report of the Treasurer (Bulletin 58)	164
Index to report	167

ANNOUNCEMENTS.

THE AIM OF THE STATION.

Every citizen of Maine concerned in Agriculture, has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seeds and creamery glass-ware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published, if they prove of general interest.

INSPECTIONS.

The execution of the laws regulating the sale of commercial fertilizers, concentrated commercial feeding stuffs, and agricultural seeds, and the inspection of chemical glass-ware used by creameries is entrusted to the Director of the Station. The Station officers take pains to obtain for analysis samples of all brands of fertilizers and feeding stuffs coming under the law, but the organized co-operation of farmers is essential for the full and timely protection of their interests. Granges, Farmers Clubs and other organizations can render efficient aid by reporting any attempt at evasion of the laws and by sending, early in the season, samples taken from stock *in the market* and drawn in accordance with the Station directions for sampling. In case there should be a number of samples of the same brand sent in, the Station reserves the right to analyze only in part.

STATION PUBLICATIONS.

The Station publishes 10 to 12 bulletins each year covering in detail its expenses, operations, investigations and results. The bulletins are mailed free to all citizens who request them. The annual Report is a reprint of the bulletins of the year and is bound with the Report of the Board of Agriculture and distributed by the Secretary of the Board. This combined report can be obtained by addressing the Secretary of Agriculture, State House, Augusta, Maine.

CORRESPONDENCE.

As far as practicable, letters are answered the day they are received. Letters sent to individual officers are liable to remain unanswered, in case the officer addressed is absent. All communications should, therefore, be addressed to the

Agricultural Experiment Station,
Orono, Maine.

The post office, railroad station, freight, express and telegraph address is Orono, Maine. Visitors to the Station can take the electric cars at Bangor and Old Town.

The telephone call is "Bangor, 27-3."

Directions, forms and labels for taking samples, of fertilizers, feeding stuffs and seeds for analysis can be had on application.

Parcels sent by express should be prepaid, and postage should be enclosed in private letters demanding a reply.

Remittances should be made payable to the undersigned.

CHAS. D. WOODS, *Director*

FEEDING STUFF INSPECTION.

Samples of the feeding stuffs coming under the inspection law were drawn by the inspectors in November, 1898. The results of the chemical analyses follow. A discussion of the results of some of the analyses will be found on pages 18 to 21.

The law is working very satisfactorily indeed. There are practically no goods sold which are not properly guaranteed. That the law is keeping out low grade goods is evidenced by the following from a letter received a few weeks since: "You will please print tags as ordered for x x x x x Mill and send same by freight instead of express. We have discovered that the meal we anticipated shipping into Maine market was not of sufficient quality to meet requirements of your State. We have, therefore, concluded not to ship as anticipated. We will, later in the season, have a very nice grade of meal at x x x x Mill at which time we will place same in Maine market."

FEEDS LOW IN PROTEIN.

Very few farmers can afford to buy feeds low in protein and high in carbohydrates at any price at which they have been or are likely to be offered. The farmer should grow all the coarse feeds that he needs. Oat and similar feeds are very much like corn stalks or oat straw in composition. Some of the feeds have cottonseed or other nitrogenous feeding stuffs added to them so that they carry more protein than straight oat feeds, but these mixtures are always more expensive sources of protein than are the glutens, cottonseed and linseed meals. One hundred pounds of an ordinary oat feed has from eight to eleven pounds protein. At seventy-five cents per hundred the protein costs from seven to nine cents a pound. One hundred pounds of a good gluten meal has from thirty-four to forty per cent of protein. At $1.10 per hundred the protein costs about three cents a pound and it not only costs less than half as much but it is better digested. As a source of protein, it would be as good economy to pay $60.00 a ton for high grade cottonseed meal as to pay $15.00 a ton for the ordinary oat feed.

MANUFACTURERS AND PLACE OF SAMPLING.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8278	American Cotton Oil Co	Huntsville, Ala	Pittsfield
8282	American Cotton Oil Co	Huntsville, Ala	Bowdoinham
8338	American Cotton Oil Co	Huntsville, Ala	East Sumner
8279	American Cotton Oil Co	Pine Bluff, Ark	Pittsfield
8280	American Cotton Oil Co	Little Rock, Ark	Dexter
8283	American Cotton Oil Co	Brinkley, Ark	Newport
8281	American Cotton Oil Co	Memphis, Tenn	Belfast
8284	American Cotton Oil Co	Jackson, Tenn	Belfast
8285	American Cotton Oil Co	Jackson, Tenn	Rockland
8337	American Cotton Oil Co	Jackson, Tenn	Dixfield
8339	American Cotton Oil Co	Nashville, Tenn	East Sumner
8380	American Cotton Oil Co	Nashville, Tenn	Monmouth
8389	American Cotton Oil Co	Nashville, Tenn	Auburn
8349	American Cotton Oil Co		Buxton Center
8286	The Southern Cotton Oil Co	Little Rock, Ark	Bath
8289	J. E. Soper & Co		Newport
8381	J. E. Soper & Co		Augusta
8293	R. B. Brown Oil Co		Dexter.
8294	R. B. Brown Oil Co		Corinna
8295	S. W. Thaxter & Co	Benham, Texas	Bucksport.
8296	S. W. Thaxter & Co	Benham, Texas	Orrington
8297	S. W. Thaxter & Co	Benham, Texas	Thomaston
8287	S. W. Thaxter & Co	Benham, Texas	Winterport
8290	F. W. Brodé & Co	Memphis, Tenn	Brunswick
8291	F. W. Brodé & Co	Memphis, Tenn	Dexter
8292	F. W. Brodé & Co	Memphis, Tenn	Foxcroft
8340	F. W. Brodé & Co	Memphis, Tenn	W. Minot
8341	F. W. Brodé & Co	Memphis, Tenn	Canton
8350	F. W. Brodé & Co	Memphis, Tenn	Buxton Center
8364	F. W. Brodé & Co	Memphis, Tenn	Bridgton
8382	F. W. Brodé & Co	Memphis, Tenn	Monmouth
8390	F. W. Brodé & Co	Memphis, Tenn	Lewiston
8402	F. W. Brodé & Co	Memphis, Tenn	Houlton
8288	I. A. Barstow		Bangor
8391	C. S. O. Co		Farmington
8308	Chas. Pope Glucose Co	Chicago, Ill	Camden
8309	Chas. Pope Glucose Co	Chicago, Ill	Orrington
8310	Chas. Pope Glucose Co	Chicago, Ill	Brunswick
8345	Chas. Pope Glucose Co	Chicago, Ill	South Paris
8353	Chas. Pope Glucose Co	Chicago, Ill	Saco
8367	Chas. Pope Glucose Co.	Chicago, Ill	Portland
8395	Chas. Pope Glucose Co	Chicago, Ill	Lewiston
8298	The Glucose Sugar Refining Co.		Thomaston
8299	The Glucose Sugar Refining Co.		Brunswick
8300	The Glucose Sugar Refining Co.		Bucksport
8301	The Glucose Sugar Refining Co.		Bangor
8302	The Glucose Sugar Refining Co.		Belfast
8303	The Glucose Sugar Refining Co.		Winterport

ANALYSES OF SAMPLES.

Name of feed.	Moisture—per cent.	Protein. Found—per cent.	Protein. Guaranteed—per cent.	Fat. Found—per cent.	Fat. Guaranteed—per cent.	Station number.
Prime Cotton Seed Meal	7.55	42.25	43.00	11.48	9.00	8278
Prime Cotton Seed Meal	8.57	46.44	43.00	10.23	9.00	8282
Prime Cotton Seed Meal	8.36	43.94	43.00	9.77	9.00	8338
Prime Cotton Seed Meal	8.10	45.38	43.00	10.43	9.00	8279
Prime Cotton Seed Meal	8.30	45.50	43.00	9.43	9.00	8280
Prime Cotton Seed Meal	6.67	47.13	43.00	12.46	9.00	8283
Prime Cotton Seed Meal	7.98	42.25	43.00	13.32	9.00	8281
Prime Cotton Seed Meal	9.21	47.81	43.00	8.80	9.00	8284
Prime Cotton Seed Meal	8.90	47.00	43.00	10 78	9.00	8285
Prime Cotton Seed Meal	9.73	46.94	43.00	10.33	9.00	8337
Prime Cotton Seed Meal	8.48	46.69	43.00	10.31	9.00	8339
Prime Cotton Seed Meal	7.42	46.75	43.00	11.26	9.00	8380
Prime Cotton Seed Meal	7.71	46.00	43.00	11.47	9.00	8389
Prime Cotton Seed Meal	8.59	45.82	43.00	10.51	9.00	8349
Prime Cotton Seed Meal	8.46	46.82	43.00	9.76	9.00	8286
Cotton Seed Meal	8.40	46.13	43.00	8.78	9.00	8289
Cotton Seed Meal	6.27	44.75	43.00	14.72	9.00	8381
Prime Cotton Seed Meal	9.32	47.88	43.00	8.34	9.00	8293
Prime Cotton Seed Meal	8.20	46.75	43.00	9.97	9.00	8294
Cotton Seed Meal	8.33	48.69	49.25	11.25	15.62	8295
Cotton Seed Meal	8.54	50.06	49.25	10.87	15.62	8296
Cotton Seed Meal	7.70	51.26	49.25	10.33	15.62	8297
Cotton Seed Meal	7.46	51.92	49.25	10.71	15.62	8287
Owl Brand Cotton Seed Meal	8.46	44.50	43.00	11.38	9.00	8290
Owl Brand Cotton Seed Meal	7.84	44.63	43.00	10.63	9.00	8291
Owl Brand Cotton Seed Meal	7.50	45.32	43.00	11.50	9.00	8292
Owl Brand Cotton Seed Meal	8.20	46.38	43.00	9.90	9.00	8340
Owl Brand Cotton Seed Meal	7.24	43.31	43.00	13.13	9.00	8341
Owl Brand Cotton Seed Meal	8.30	43.31	43.00	12.08	9.00	8350
Owl Brand Cotton Seed Meal	7.52	45.13	43.00	12.41	9.00	8364
Owl Brand Cotton Seed Meal	8.09	44.75	43.00	12.49	9.00	8382
Owl Brand Cotton Seed Meal	7.30	44.50	43.00	12.59	9.00	8390
Owl Brand Cotton Seed Meal	9.28	45.00	43.00	12.87	9.00	8402
Sea Island Cotton Seed Meal	10.73	21.82	20.13	5.83	4.57	8288
Sea Island Cotton Seed Meal	10.98	25.06	24.31	7.09	5.00	8391
Cream Gluten Meal	9.79	30.94	37.12	3.38	3.20	8308
Cream Gluten Meal	8.92	33.50	37 12	5.43	3.20	8309
Cream Gluten Meal	9.48	34.88	37.12	2.24	3.20	8310
Cream Gluten Meal	10.04	33.81	37.12	3.49	3.20	8345
Cream Gluten Meal	8.48	35.69	37.12	2.73	3.20	8353
Cream Gluten Meal	9.27	32.56	37.12	4.32	3.20	8367
Cream Gluten Meal	9.35	31.19	37.12	3.13	3.20	8395
Chicago Gluten Meal	10.56	37.13	37.50	2.59	9.00	8298
Chicago Gluten Meal	11.02	39.63	37.50	1.94	9.00	8299
Chicago Gluten Meal	11.15	36.13	36.00	2.49	3.37	8300
Chicago Gluten Meal	10.76	38.82	38.00	2.79	2.00	8301
Chicago Gluten Meal	10.52	38.63	38.00	2.01	2.00	8302
Chicago Gluten Meal	10.23	37.69	37.50	2.13	9.00	8303

MANUFACTURERS—CONTINUED.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8304	The Glucose Sugar Refin. Co		Foxcroft
8342	The Glucose Sugar Refin. Co		Minot
8351	The Glucose Sugar Refin. Co		Buxton Center
8365	The Glucose Sugar Refin. Co		Bridgton
8375	The Glucose Sugar Refin. Co		Milltown
8376	The Glucose Sugar Refin. Co		Calais
8383	The Glucose Sugar Refin. Co		Waterville
8392	The Glucose Sugar Refin. Co		Lewiston
8305	National Starch Manf'g Co	Indianapolis, Ind.	Foxcroft
8306	National Starch Manf'g Co	Indianapolis, Ind.	Richmond
8343	National Starch Manf'g Co	Indianapolis, Ind.	Canton
8393	National Starch Manf'g Co	Indianapolis, Ind.	Lewiston
8394	National Starch Manf'g Co	Des Moines, Iowa	Farmington
8384	National Starch Manf'g Co	Des Moines, Iowa	Oakland
8344	National Starch Manf'g Co	Des Moines, Iowa	Dixfield
8307	National Starch Manf'g Co	Des Moines, Iowa	Dexter
8352	National Starch Manf'g Co	Des Moines, Iowa	Springvale
8358	National Starch Manf'g Co		North Yarmouth
8366	National Starch Manf'g Co		Gorham
8311	Arthur R. Hopkins	Bangor	Bangor
8312	American Glucose Co		Dexter
8327	S. W. Thaxter & Co		Bath
8346	The Glucose Sugar Refin. Co		West Paris
8354	The Glucose Sugar Refin. Co		Berwick
8377	The Glucose Sugar Refin. Co		Calais
8396	The Glucose Sugar Refin. Co		Auburn
8328	Douglas & Co		Brunswick
8329	The Cleveland Linseed Oil Co		Rockland
8330	The Cleveland Linseed Oil Co		Belfast
8313	The American Cereal Co		Bucksport
8314	The American Cereal Co		Brunswick
8316	The American Cereal Co		Rockland
8317	The American Cereal Co		Foxcroft
8347	The American Cereal Co		West Paris
8357	The American Cereal Co		Waterboro
8369	The American Cereal Co		Fryeburg
8378	The American Cereal Co		Eastport
8385	The American Cereal Co		Skowhegan
8397	The American Cereal Co		Auburn
8403	The American Cereal Co		Houlton
8315	S. A. & J. H. True		Brunswick
8318	The American Cereal Co		Newport
8319	The American Cereal Co		Brunswick
8320	The American Cereal Co		Rockland
8321	The American Cereal Co		Foxcroft
8348	The American Cereal Co		West Paris
8356	The American Cereal Co		Waterboro
8368	The American Cereal Co		South Windham

ANALYSES—CONTINUED.

Name of Feed.	Moisture—per cent.	Protein.		Fat.		Station number.
		Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Chicago Gluten Meal	10.47	40.63	37.50	1.70	9.00	8304
Chicago Gluten Meal	11.58	36.88	36.00	1.98	3.37	8342
Chicago Gluten Meal	10.98	37.50	37.50	1.89	9.00	8351
Chicago Gluten Meal	11.28	39.69	38.00	1.92	2.00	8365
Chicago Gluten Meal	11.72	37.07	38.00	2.05	2.00	8375
Chicago Gluten Meal	11.37	36.88	37.50	2.20	9.00	8376
Chicago Gluten Meal	10.50	38.44	37.50	1.80	9.00	8383
Chicago Gluten Meal	10.52	37.50	37.50	2.61	9.00	8392
King Gluten Meal	9.44	34.06	32.00	4.28	16.00	8305
King Gluten Meal	6.69	37.32	32.00	5.06	16.00	8306
King Gluten Meal	9.34	34.69	32.00	4.30	16.00	8343
King Gluten Meal	7.91	35.75	32.00	6.87	16.00	8393
King Gluten Meal	7.04	32.44	32.00	15.57	16.00	8394
King Gluten Meal	6.04	33.13	32.00	15.54	16.00	8384
King Gluten Meal	7.87	31.50	34.26	13.24	14.65	8344
King Gluten Meal	6.34	32.82	32.00	15.41	16.00	8307
King Gluten Meal	8.28	32.81	32.00	16.40	16.00	8352
King Gluten Meal	8.20	33.25	32.00	16.30	16.00	8358
King Gluten Meal	7.07	32.06	32.00	15.90	16.00	8366
Imperial Gluten Meal	9.20	20.13	20.00	12.00	11.50	8311
Buffalo Gluten Feed	9.27	28.25	29.00	4.68	3.00	8312
Gluten Feed	10.26	22.63	*	5.93	*	8327
Rockford Diamond Gluten Feed	10.50	25.44	24.20	4.08	3.75	8346
Rockford Diamond Gluten Feed	9.44	25.44	24.20	3.44	3.75	8354
Rockford Diamond Gluten Feed	8.94	24.69	24.20	3.86	3.75	8377
Rockford Diamond Gluten Feed	7.34	25.75	24.20	4.43	3.75	8396
Old Process Oil Meal	9.00	26.63	36.94	6.45	6.58	8328
Cleveland Flax Meal	11.68	39.75	39.00	2.28	1.50	8329
Linseed Oil Meal	10.40	36.81	39.00	2.52	1.50	8330
Victor Corn and Oat Feed	9.52	9.56	9.46	4.31	3.92	8313
Victor Corn and Oat Feed	9.21	8.12	9.46	3.36	3.92	8314
Victor Corn and Oat Feed	9.31	9.94	9.46	4.44	3.92	8316
Victor Corn and Oat Feed	10.67	8.88	9.46	3.84	3.92	8317
Victor Corn and Oat Feed	10.20	9.06	9.46	3.18	3.92	8347
Victor Corn and Oat Feed	10.57	8.88	9.46	2.85	3.92	8357
Victor Corn and Oat Feed	8.90	9.69	9.46	4.92	3.92	8369
Victor Corn and Oat Feed	9.46	9.38	9.46	4.87	3.92	8378
Victor Corn and Oat Feed	8.54	8.75	9.46	3.53	3.92	8385
Victor Corn and Oat Feed	9.15	8.38	9.46	3.31	3.92	8397
Victor Corn and Oat Feed	11.25	9.02	9.46	3.57	3.92	8403
Corn and Oat Feed	9.80	8.38	9.63	3.44	4.23	8315
Quaker Oat Feed	8.94	9.44	12.03	2.57	3.49	8318
Quaker Oat Feed	8.36	10.31	12.03	3.61	3.49	8319
Quaker Oat Feed	8.32	11.13	12.03	3.57	3.49	8320
Quaker Oat Feed	7.48	7.44	12.03	2.98	3.49	8321
Quaker Oat Feed	8.27	10.31	12.03	3.29	3.49	8348
Quaker Oat Feed	9.51	10.38	12.03	2.87	3.49	8356
Quaker Oat Feed	7.95	10.88	12.03	3.79	3.49	8368

---

* Not guaranteed.

MANUFACTURERS—CONCLUDED.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8399	The American Cereal Company		Lewiston
8322	The American Cereal Company		Brunswick
8323	The American Cereal Company		Richmond
8373	W. H. Haskell & Company		Portland
8398	Andrew Cullen & Company		Auburn
8400			Auburn
8324	The H-O Company	Buffalo	Bowdoinham
8372	The H-O Company	Buffalo	Freeport
8386	The H-O Company	Buffalo	Bangor
8325	The H-O Company	Buffalo	Richmond
8371	The H-O Company	Buffalo	Freeport
8388	The H-O Company	Buffalo	Bangor
8326	The H-O Company	Buffalo	Richmond
8370	The H-O Company	Buffalo	Freeport
8387	The H-O Company	Buffalo	Bangor
8331	E. W. Blatchford & Company		Brunswick
8332	The Bowker Fertilizer Co		Belfast
8333	The Bowker Fertilizer Co		Brunswick
8334	The Bowker Fertilizer Co		Camden
8355	The Bowker Fertilizer Co		Buxton Center
8374	The Bowker Fertilizer Co		Gorham
8335	Bradley Fertilizer Company		Belfast
8336	Bradley Fertilizer Company		Belfast

ANALYSES—CONCLUDED.

Name of Feed.	Moisture—per cent.	PROTEIN.		FAT.		Station number.
		Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Quaker Oat Feed	7.77	10.75	12.03	3.97	3.49	8399
American Poultry Food	9.82	14.19	*	5.91	*	8322
Corn, Oat and Barley Feed	9.42	12.75	11.26	5.39	4.15	8323
Haskell's Oat Feed	9.13	11.31	9.62	7.91	7.66	8373
Crescent Oat Feed	7.42	8.63	*	3.72	*	8398
Monarch Oat Feed	8.78	11.19	10.25	8.79	7.47	8400
The H-O Co.'s Poultry Feed	10.26	17.81	16.80	5.43	7.00	8324
The H-O Co.'s Poultry Feed	9.43	18.00	16.80	5.76	7.00	8372
The H-O Co.'s Poultry Feed	9.50	18.31	16.80	5.92	7.00	8386
The H-O Co.'s Stand. Dairy Feed	8.19	20.38	18.75	5.42	7.25	8325
The H-O Co.'s Stand. Dairy Feed	8.30	20.94	18.75	5.39	7.25	8371
The H-O Co.'s Stand. Dairy Feed	8.52	17.06	18.75	4.24	7.25	8388
The H-O Co.'s Horse Feed	9.80	11.94	12.30	3.81	4.90	8326
The H-O Co.'s Horse Feed	10.91	11.81	12.30	4.51	4.90	8370
The H-O Co.'s Horse Feed	9.06	11.69	12.30	4.75	4.90	8387
Blatchford's Calf Meal	8.36	33.41	*	5.23	*	8331
Bowker's Animal Meal	5.64	41.07	30.00	14.05	5.00	8332
Bowker's Animal Meal	5.67	44.31	30.00	12.05	5.00	8333
Bowker's Animal Meal	6.11	44.94	30.00	12.94	5.00	8334
Bowker's Animal Meal	5.62	41.75	30.00	13.40	5.00	8355
Bowker's Animal Meal	6.04	40.50	30.00	12.32	5.00	8374
Bradley's Superior Meat Meal	6.06	43.56	40.00	15.95	15.00	8335
Old Fashioned Beef Scraps	7.93	49.13	40.00	19.60	10.00	8336

* Not guaranteed.

SUMMARY OF ANALYSES.

			PROTEIN.		FAT.	
	Number of analyses.		Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
American Cotton Oil Co.'s Prime Cotton Seed Meal.	14	Highest	47.81	....	13.32	9.00
		Lowest	42.25	43.00	8.80	
		Average	45.71	....	10.75	
Southern Cotton Oil Co.'s Prime Cotton Seed Meal.	1	....	46.82	43.00	9.76	9.00
J. E. Soper & Co.'s Cotton Seed Meal.	2	Highest	46.13	....	14.72	9.00
		Lowest	44.75	43.00	8.78	
		Average	45.44	....	11.75	
R. B. Brown Oil Co.'s Prime Cotton Seed Meal.	2	Highest	47.88	....	9.97	9.00
		Lowest	46.75	43.00	8.34	
		Average	47.32	....	9.16	
S.W. Thaxter & Co.'s Cotton Seed Meal.	4	Highest	51.92	....	11.25	15.62
		Lowest	48.69	49.25	10.33	
		Average	50.48	....	10.79	
F. W. Brodé & Co.'s Owl Brand Cotton Seed Meal.	10	Highest	46.38	....	13.13	9.00
		Lowest	43.31	43.00	9.30	
		Average	44.68	....	11.90	
Sea Island Cotton Seed Meal.	2	Highest	25.06	....	7.09	*
		Lowest	21.82	*	5.83	
		Average	23.44	....	6.46	
Charles Pope Glucose Co.'s Cream Gluten Meal.	7	Highest	35.69	....	5.43	3.20
		Lowest	30.94	37.12	2.24	
		Average	33.22	....	3.53	
The Glucose Sugar Refin'g Co.'s. Chicago Gluten Meal.	14	Highest	40.63	38.00	2.79	3.37
		Lowest	36.13	36.00	1.70	2.00
		Average	38.01	....	2.15	
National Starch M'f'g Co.'s King Gluten Meal.	11	Highest	37.32	....	16.40	16.00
		Lowest	31.50	32.00	4.28	
		Average	33.62	....	11.72	
Arthur R. Hopkins's Imperial Gluten Meal.	1	....	20.13	20.00	12.00	11.50
American Glucose Co.'s Buffalo Gluten Feed.	1	....	28.25	29.00	4.68	3.00
S. W. Thaxter & Co.'s Gluten Feed.	1	.. ..	22.63	....	5.93	......
The Glucose Sugar Refin'g Co.'s Rockford Diamond Glut. Feed.	4	Highest	25.75	....	4.43	3.75
		Lowest	24.69	24.20	3.44	
		Average	25.33	....	3.95	
Douglas & Co.'s. Old Process Oil Meal.	1	....	26.63	36.94	6.45	6.58
Cleveland Linseed Oil Co.'s Cleveland Flax Meal.	1	....	39.75	39.00	2.28	1.50
Cleveland Linseed Oil Co.'s Linseed Oil Meal.	1	.. ..	36.81	39.00	2.52	1.50

* For guarantees see page 11.

SUMMARY OF ANALYSES—CONCLUDED.

	Number of analyses.		PROTEIN.		FAT.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
The American Cereal Co.'s Victor Corn and Oat Feed.	11	Highest	9.94	....	4.92	3.92
		Lowest	8.12	9.46	2.85	
		Average	9.06	....	3.83	
S. A. & J. H. True Co.'s Corn and Oat Feed.	1	... .	8.38	9.63	3.44	4.23
The American Cereal Co.'s Quaker Oat Feed.	9	Highest	11.13	....	3.97	3.49
		Lowest	7.44	12.03	2.57	
		Average	8.96	....	2.96	
The American Cereal Co.'s American Poultry Food.	1	....	14.19	... .	5.91	.....
The American Cereal Co.'s Corn, Oat and Barley Feed.	1	....	12.75	11.26	5.39	4.15
W. H. Haskell & Co.'s Haskell's Oat Feed.	1	....	11.31	9.62	7.91	7.66
Andrew Cullen & Co.'s Crescent Oat Feed.	1	....	8.63	....	3.72	......
Monarch Oat Feed.	1	....	11.19	10.25	8.79	7.47
The H-O Co.'s Poultry Feed.	3	Highest	18.31	... .	5.92	7.00
		Lowest	17.81	16.80	5.43	
		Average	18.04	....	5.70	
The H-O Co.'s Standard Dairy Feed.	3	Highest	20.94	....	5.42	7.25
		Lowest	17.06	18.75	4.24	
		Average	19.46	....	5.02	
The H-O Co.'s Horse Feed.	3	Highest	11.94	....	4.75	4.90
		Lowest	11.69	12.30	3.81	
		Average	11.81	. ...	4.36	
E. W. Blatchford's Calf Meal.	1	....	33.44	... .	5.23	.....
Bowker Fertilizer Co.'s Bowker's Animal Meal.	5	Highest	44.94	....	14.05	5.00
		Lowest	40.50	30.00	12.05	
		Average	42.51	....	12.95	
Bradley Fertilizer Co.'s Superior Meat Meal.	1	... .	43.56	40.00	15.95	15.00
Bradley Fertilizer Co.'s, Old Fashioned Beef Scraps.	1	....	49.13	40.00	19.60	10.00

J. M. BARTLETT, *Chemist.*

O. W. KNIGHT, } *Assistant*
A. J. PATTEN, } *Chemists.*

COTTON SEED MEAL.

Pure cotton seed meal is made by grinding the seed after the white down, which remains upon the seed as it comes from the gotton gin, and the hard hulls have been removed. Decorticated cotton seed meal thus prepared carries from forty to fifty-three per cent of protein. From the ease with which hulls may be ground with the cotton seed, this class of goods offers peculiar opportunity to dishonest manufacturers and dealers. When the feeding stuff law went into effect in the fall of 1897 the State was filled with inferior goods carrying from twenty-two to thirty per cent of protein. In the spring of 1898 the inspectors reported a few lots of these goods. In November, 1898, only two lots of low grade cotton seed meal were found by the inspectors, and these samples were guaranteed in accordance with their low grade. Occasionally the Station has had sent to it by correspondents samples of suspected meal, but analyses have shown them to be up to guarantee.* Not all dark colored meal is adulterated and not all bright yellow meal is free from adulteration. The following statement made in bulletin 44 apparently represents the status of low grade cotton seed meal at present: "Goods of this type were very abundant in this State in 1897 but there are almost none of them to be found at present. The inspection law has driven them to other states."

As will be seen from the analyses the cotton seed meals agree quite closely with the guaranteed analyses.

GLUTEN MEALS AND FEEDS.

Gluten meals and gluten feeds are by-products left in the manufacture of starch and glucose from Indian corn. Corn consists largely of starch. The waste product from the manufacture of starch or sugar is relatively much richer in oil and protein than corn. Many factories are removing part of the corn oil from the waste, so that some gluten meals carry but little oil. This reduction in fat is an advantage, as feeding corn oil to dairy animals seems to have a tendency to make the butter soft. No by-products used for feeding differ more from each other than do these starch and sugar wastes. All manufacturers apparently do not recognize that the composition of these offals change greatly, and some of them have based their guarantees upon old analyses.

---

* After this Bulletin was in press one low grade *unguaranteed* sample has been received.

Cream gluten meal is not up to the guarantee in protein. It is guaranteed to carry thirty-seven per cent, but from the samples drawn the purchaser can not expect more than thirty-three per cent of protein on the average, and one sample ran as low as thirty-one per cent of protein. The attention of the handlers of this feed has been called to these discrepancies between guarantee and analysis and they will probably be corrected on future shipments.

Fourteen samples of Chicago gluten meal were collected by the inspectors. These samples represent both old and new goods. The old goods were guaranteed too high in fat. The present guarantee, thirty-eight per cent protein and two per cent fat, fairly well represents the goods on the market. The protein found in the samples examined, agrees as closely as can be expected with the guarantees. The State agents seem to be anxious that their guarantees shall represent the goods as sold.

King gluten meal as sold in Maine comes from two mills, the output of which differs greatly in composition. The goods made at the Des Moines mill are very close with the guarantee, thirty-two per cent protein and sixteen per cent fat; the goods from the Indianapolis mills are higher in protein than the guarantee and are correspondingly low in fat. The Indianapolis goods carry about thirty-four per cent protein and four per cent of fat. The attention of the dealers has been called to this and the goods will by correctly branded in the near future.

GLUTEN FEEDS.

But little gluten feed is offered in the State. That found agreed in composition with the guarantee. At Bath a small amount of gluten feed was found which did not carry any guarantee.

LINSEED MEAL.

Only three samples of linseed meal were found by the inspectors. Its high cost, relative to cottonseed meal, has apparently crowded it out of the market. The guarantee of Douglass & Company's oil meal was based upon an analysis of a sample sent to the Station months before by the wholesaler, who writes as follows: "When you analyzed our oil meal we had a large quantity on hand, and we tagged as you directed. It is so high now that very little is sold and we have had a few lots that we have sold and we supposed was of same quality. We have not at present a single sack in our store."

OAT FEEDS.

A number of samples of different oat feeds have been examined. For the most part guarantees are based upon single analyses of the feeds and the goods usually are not quite as good as the sample upon which the guarantee rests. With the exception of the American Cereal Company's Quaker Oat Feed none of these materials are much below and some run above the guarantee.

BLATCHFORD'S CALF MEAL.

This is a manufactured food only one lot of which was found by our inspectors. This was not guaranteed but carried 33.44% protein and 5.23% of fat. In some advertising matter connected with Blatchford's calf meal it is claimed that 12.8 pounds of it has three and one-half pounds of protein, which is about twenty-seven and one-half per cent. A sample of these goods sent by a dealer to the Station in September analyzed as follows:

Water, 7.70%; ash, 5.46%; protein, 25.63%; crude fiber, 5.28%; starch, 18.24%; undetermined carbohydrates, 32.13%; fat, 5.56%. It will be observed that the goods as evidenced by the official sample and this lot sent to the Station are very uneven in composition;—one sample carrying about 26% and the other about 33% of protein. A large part of the ash is common salt.

These goods were sent to an expert on food mixtures and adulterations at the Connecticut Experiment Station who reports as follows: "I have examined Blatchford's calf meal under the microscope and find it contains linseed meal, some product from the wheat kernel, some product from the bean kernel and a little fenugreek. The linseed meal appears to be the chief constituent. The wheat product is bran, middlings or some similar product consisting of starchy matter mixed with more or less of the seed coats. Bean bran was present in considerable amount and more or less of the starchy matter."

In a letter just at hand from Mr. J. W. Barwell, the proprietor of these goods, he says: "Regarding the ingredients, I cannot give you the exact constituents of it, but I may say that it is composed mostly of locust bean meal with leguminous seeds such as lentils, etc., and oleaginous seeds such as flax-seed, fenugreek and annis seed, all cleaned, hulled and ground together and thoroughly well cooked. There is no cheap mill food and no low grade feed enters into this composition. I am prepared to go into any court in the United States and make an affidavit that there is no farmer in the United States that can compound Blatchford's calf meal for less than $3.50 per hundred."

Locust bean meal which Mr. Barwell claims to be the chief constituent of Blatchford's calf meal is practically not used in this country as a cattle feed. The average of ten English and German analyses show it to carry:—water, 14.96%; ash, 2.53%; protein, 5.86%; crude fiber, 6.39%; nitrogen-free extract, 68.98%; fat, 1.28%.

It is evident from the chemical analysis that locust bean meal cannot be the chief constituent of Blatchford's calf meal, but that the microscopist is correct that linseed meal is the chief constituent. Locust bean meal has only six per cent of protein and in order to make a mixture carrying from twenty-six to thirty-three per cent of protein, it would be necessary to add large quantities of goods like linseed meal rich in protein. As seen from the analysis Blatchford's calf meal has a feeding value somewhat inferior to old process linseed meal. Whatever it may cost to manufacture, no man who has sufficient intelligence to mix feeds can afford to buy it at anything like the price asked.

CHIEF REQUIREMENTS OF THE LAW.

The points of the law of most interest both to the dealer and consumer are concisely stated below.

Kinds of Feed coming within the Law. The law applies to all feeding stuffs *except* hays and straws; whole seeds and meals of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn; brans and middlings. The principal feeds coming under the provisions of the law are linseed meals, cottonseed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewer's grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, ground beef or fish scraps, mixed feeds, and all other materials of similar nature.

Inspection Tax and Tag. To meet the expenses of inspection, a tax of ten cents per ton must be paid to the Director of the Maine Agricultural Experiment Station. On receipt of the inspection tax, the Director of the Station is required to furnish a tag stating that all charges have been paid. This tag must be affixed to the package before it is offered for sale.

The Brand. Each package of feeding stuff included within the law shall have affixed the inspection tax tag and shall also bear, conspicuously printed, the following statements:

The number of net pounds contained in the package.
The name or trade mark under which it is sold.
The name of the manufacturer or shipper.
The place of manufacture.
The place of business of manufacturer or shipper.
The percentage of crude protein.
The percentage of crude fat.

These statements may be printed directly on the bag, on a tag attached to the package, or on the back of the inspection tax tag furnished by the Director of the Station.

A copy of the statement of brand must be filed with the Director of the Station. The goods must carry the inspection tax tag and the brand before they can be legally offered for sale in the State. It will not answer to affix tags at the time the goods are sold.

FREE ANALYSIS OF FEEDING STUFFS.

The Station officers take pains to obtain for analysis samples of all feeding stuffs coming under the law, but the co-operation of consumers is essential for the full and timely protection of their interests. Whenever any one believes that the law is being evaded in any way, he is requested to notify the Director of the Station.

The Station will promptly analyze, free of charge, samples of feeding stuffs *taken in accordance with directions furnished by the Station,* and report the results to the interested parties. Blanks containing full directions for drawing and forwarding samples will be sent on application.

CHAS. D. WOODS, *Director.*

CARE OF ORCHARDS.

W. M. MUNSON.

The fact that the apple is spontaneous in many parts of the State, and that orchards will exist and bear a partial crop of fruit though utterly neglected, is responsible for much of the ill-treatment seen on every hand. There is little doubt, however, that a well managed orchard is a most valuable farm property, and one of the surest sources of income. In view of the large number of orchards needing care, throughout the State, attention will, at this time, be given to this point rather than to planting.

RENOVATION.

Repair is not necessarily associated with old age and decay. Apple trees ten or fifteen years old sometimes need repairing quite as much as do old and neglected ones. When the orchard to be treated has been neglected for many years, the first operation, if the land does not need draining, is to prune thoroughly. In this operation, which may be performed at any time from late fall till the middle of May, care should be used that the trees are given an open head. This does not imply that all small side limbs should be removed, leaving a lot of whipstocks, but that such of the larger limbs as are parallel and close together, or those which cross, should be cut out. Half of the difficulty of pruning is done away with if one decides to allow the tree its natural form, rather than to attempt to shape it to some particular model.

Many growers suppose that pruning weakens the tree and shortens its life. There is, however, no reason for this belief, other than the general statement that "pruning is unnatural." But pruning is not unnatural. Man seldom prunes so heavily as does nature in removing superfluous limbs in the growth of young saplings in the forest. Furthermore, nature prunes at all seasons and in the rudest ways. By this it should not be understood, however, that care is not necessary in the mechanical operation of pruning. On the other hand, it is of the greatest importance that large limbs be removed with care and the wounds painted to prevent the entrance of fungi which will induce decay.

Trees are sometimes broken by heavy loads of fruit or by ice. In such matters, prevention is better than cure, and in training young trees, all crotches should be avoided. If bad crotches should be found to exist in trees ten or more years old, they should be braced by means of an iron bolt. Much damage may be avoided if bolts are used in season.

If the land on which the orchard is located has never been plowed, the surest way of stirring the soil and working in the necessary fertilizer is to fence off a portion of the area to be renovated, and turn in several hogs. The hogs, in rooting for grubs, will stir the soil as completely as would be possible with plow and harrow. The value of this treatment has been fully demonstrated at the farm of Charles S. Pope, Manchester, where most of the orchard work of this Station has been conducted. An orchard some fifty years old, which had not been plowed for more than twenty years, was treated as above noted, ten hogs being placed in the enclosure of about one and one-half acres in extent. The trees in this enclosure assumed a brighter, richer color which was noticeable from the street, half a mile distant. No accurate account of the yield of the trees in this plot as compared with others was kept, but Mr. Pope reports that there was a decided difference both in yield and in quality of the fruit. So satisfactory were the results that each year since the first trial a new area is set apart for similar treatment.

Not infrequently, during winters when the snow remains long on the ground, apple trees will be girdled by mice and rabbits. In such a case, "bridge grafting" is often practiced with satisfactory results; *i. e.* cions are set at frequent intervals about the trunk of the tree, one end being inserted underneath the bark above the wound, the other below. In this way the circulation of sap is maintained and the tree may be saved. The wound should be covered with grafting wax or with fresh cow dung, to exclude the air.

GRAFTING.

In starting a new orchard it is usually advisable to set trees which have been grafted in the nursery, rather than to set chance seedlings with the expectation of top-grafting them. Some varieties, as the Baldwin, do better when "top-worked," but even for such, nursery grown stock of Ben Davis, Northern Spy, Pewaukee or some other hardy, vigorous sort will give more uniform and satisfactory results than will seedlings.

While, in general, it is well to avoid top-grafting, there are few orchards in which some such work is not necessary, and many worthless seedlings, along the roadside and in the pastures, may be converted into valuable sources of income. The most successful grafting is that which disturbs the tree least. The first rule to observe, in grafting large trees is: "Graft many and small limbs." Before commencing to graft, decide carefully at what distance from the body, or from the center of the top, the main limbs should be cut to insure a good top. If a spread of six feet or ten feet from the center is decided upon, graft all of the main branches at that distance. In other words, one must plan for the future top of the tree; simply making the cions grow, being but a part of the operation. If the tree has been properly pruned, most of the more conspicuous branches should be grafted, and to avoid long pole-like limbs some cions should be set on the side branches of all the larger limbs. The practice of grafting a few large stubs low down, is not to be commended; the shock of removing a large portion of the top at one time is a serious one, and there is often injury from sunscald. A good grafter will leave enough small brush in the center of the tree to screen the trunk and larger branches.

Old neglected trees which are to be worked over, may with profit be given a preparatory pruning a year or two before grafting. Unnecessary limbs can be cut out better before grafting than afterwards. The ungrafted limbs must be gradually removed; the removal being made annually to about the extent of the growth of the cions, or a little more.

FERTILIZING.

The profit in fruit growing lies in securing an extra large amount of fruit of superior quality. This end can only be attained by the addition of a supply of plant-food in excess of that demanded for the growth of the trees. How much plant-food should be added is simply a matter of business that must be settled by each individual for his own farm. The actual fertility of the soil depends upon the plant as well as upon the amount and kind of plant-food in the soil; for only when the plant is in a healthy, vigorous condition can the maximum amount of food be appropriated. In most cases, as much depends upon the physical condition of the soil, as upon its chemical constitution.

In general, a liberal application of ground bone or phosphatic rock and of hardwood ashes will be found the most satisfactory fertilizing material for orchards. Stable manure may also be used with good effect, on soils deficient in organic matter; though for most orchards potash and phosphoric acid are desired, rather than nitrogen.

CULTURE.

Many good orchards are so located that cultivation is out of the question. There is no doubt, however, that where possible, thorough culture, especially while the orchard is young, is much to be desired. By cultivation, the soil is rendered in better condition for the feeding roots, the plant food is thus rendered more available, and the moisture is better conserved than in any other way. During the first years after planting, hoed crops may be grown between the trees, provided sufficient fertilizers are used. In no case, however, should a grain crop be grown, except as a cover crop to be plowed under in the spring. The accompanying illustrations clearly represent the value of culture. The cut on the opposite page represents an orchard of Fameuse, Northern Spy and Milding planted, as two-year-old trees, in 1892. The above illustration shows an orchard of similar varieties planted the next year. The first has been given thorough culture and was severely pruned in 1897; the other, separated from the first only by a fence, has been left without treatment, and a crop of hay has been taken off each year. Further remark is unnecessary.

SPRAYING.

Spraying is an easy and practical way of applying insecticides and fungicides. Insecticides act in two ways: (1) By poisoning the insects, when eaten; (2) by closing the breathing pores of the insects, or acting as an external irritant. Paris green is an example of the first class; kerosene emulsion or pyrethrum of the second. Hellebore, if applied in the dry form, acts in both ways. By spraying the trees with Paris green, some particles of the poison will be lodged upon the young fruit or upon the leaves; then as the insects attempt to enter the fruit, or to eat the foliage, they are destroyed.

Fungicides are of importance solely as preventives. The coating of Bordeaux mixture, or other material, upon the fruit and leaves, kills the germinating spores of the fungi before they penetrate the plant tissue. The time of spraying will naturally vary, depending on the purpose in view and the material used. The subject has been discussed in Bulletin 29.

ORCHARD WORK NOW IN PROGRESS AT THE EXPERIMENT STATION.

The principal orchard work now in progress at the Experiment Station is along the lines of tillage and fertilizers. At the farm of Charles S. Pope, Manchester, a young orchard, set on land which has never been plowed, has been laid off in plats, part of which are treated with concentrated fertilizers, and part with stable manure. Half of the orchard has been placed under cultivation, and the other half is heavily mulched.

Another orchard, on the same farm, has been divided into plats for treatment with different salts of potash, with a view to studying the effect, if any, upon quality of fruit and susceptibility to attack of apple scab.

In Aroostook County, as noted in previous reports, some of the more promising Russian varieties of apples, plums, and cherries are under trial; also some of the hardier American sorts. Such of these as have fruited were discussed in the Annual Report of this Station for 1896.

At present there are growing in the Station nurseries several hundred of the hardier standard apples which will next year be sent to different parts of the State, where encouragement to the fruit growing industry seems necessary. These varieties include Arctic, Shiawassee Beauty, Sutton Beauty, Westfield, etc.

INSPECTION OF FERTILIZERS, 1899.

This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before March 8, 1899.

The analyses which appear here are those made from manufacturer's samples, which are deposited under affidavit that they are reasonably near in composition to the corresponding brands found in the market.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent. of nitrogen, it is evident that the dealer can not be held to have agreed to furnish more than 2 per cent., and so this percentage is taken as the actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples deposited.

Descriptive List of Manufacturers' Samples, 1899.

Station number.	Manufacturer, place of business and brand.
	HIRAM BLANCHARD, EASTPORT, ME.
2114	Blanchard's Fish, Bone and Potash
2115	Blanchard's Ground Fish Scrap, No. 2
	BOWKER FERTILIZER CO., BOSTON, MASS.
1252	Bowker's Ammoniated Dissolved Bone
1868	Bowker's Bone and Wood Ash Fertilizer
1852	Bowker's Corn Phosphate
1251	Bowker's Farm and Garden Phosphate
1257	Bowker's Fresh Ground Bone
1579	Bowker's High Grade Fertilizer
1248	Bowker's Hill and Drill Phosphate
1872	Bowker's Market Garden Manure
1389	Bowker's Potato and Vegetable Phosphate
1390	Bowker's 6 % Potato Fertilizer
1249	Bowker's Special Fertilizers, Potatoes and Vegetables
1250	Bowker's Square Brand Bone and Potash
1866	Bowker's Staple Phosphate or 3 % Fertilizer
1867	Bowker's Superphosphate with Potash
1247	Bowker's Sure Crop Phosphate
1588	Bowker's 10 % Manure
1871	Gloucester Fish and Potash
1580	Stockbridge Corn and Grain Manure
1870	Stockbridge Pea and Bean Manure
1388	Stockbridge Potato and Vegetable Manure
1391	Stockbridge Seeding Down Manure
1869	Stockbridge Strawberry Manure
1392	Stockbridge Top Dressing Manure
	BRADLEY, FERTILIZER CO., BOSTON, MASS.
2113	Bradley's Alkaline Bone with Potash
2112	Bradley's Complete Manure for Potatoes and Vegetables
1282	Bradley's Corn Phosphate
2111	Bradley's Eureka Fertilizer
1882	Bradley's Niagara Phosphate
1269	Bradley's Potato Fertilizer
1267	Bradley' Potato Manure
1265	Bradley's X. L. Phosphate
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.
1600	Bay State Defiance Phosphate
1217	Bay State Fertilizer
1219	Bay State Fertilizer for Seeding Down
1218	Bay State Fertilizer G. G
1215	King Philip Alkaline Guano for Potatoes
	THE CLEVELAND DRYER CO., BOSTON, MASS.
1607	Cleveland Fertilizer for All Crops
1608	Cleveland Pioneer Fertilizer
1264	Cleveland Potato Phosphate
2109	Cleveland Seeding Down Fertilizer
1263	Cleveland Superphosphate
	E. FRANK COE CO., NEW YORK, N. Y.
1901	E. Frank Coe's Bay State Phosphate
2117	E. Frank Coe's Columbian Special Corn Fertilizer
2118	E. Frank Coe's Columbian Special Potato Fertilizer

ANALYSES OF MANUFACTURERS' SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
			Total.					Available.		Total.			
	As ammonia or nitrates.	As organic.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2114	.51	2.44	2.95	2.50	......	2.61	1.28	2.61	2.0	3.89	4.5	3.82	4.5
2115	.49	3.64	4.13	4.47	......	3.39	.89	3.39	3.5	4.43	4.5	1.44	1.0
1252	......	......	1.88	1.50	5.32	2.51	2.05	7.83	8.0	9.88	10.0	2.17	2.0
1868	......	......	1.99	1.50	......	......	2.00	8.86	6.0	10.86	8.0	3.09	2.0
1852	......	......	1.88	1.60	......	......	2.77	8.59	7.0	11.36	9.0	2.26	2.0
1251	......	......	1.86	1.50	5.27	3.01	7.79	8.28	8.0	10.07	10.0	2.21	2.0
1257	......	......	3.10	2.25	......	......	......	......	......	17.49	18.0	......	......
1579	......	......	2.76	2.25	7.71	2.37	1.92	10.08	8.0	12.00	10.0	4.68	4.0
1248	......	......	2.60	2.25	7.36	1.87	3.08	9.23	9.0	12.31	12.0	2.52	2.0
1872	......	......	2.18	2.25	......	......	2.33	7.80	6.0	10.13	8.0	10.95	10.0
1389	......	......	1.77	1.50	3.83	3.50	5.40	7.33	8.0	12.73	10.0	2.34	2.0
1390	......	......	1.01	.75	3.93	3.88	3.86	7.81	7.0	11.67	10.0	6.38	6.0
1249	......	......	2.54	2.25	3.79	2.54	4.31	6.33	8.0	10.64	10.0	4.42	4.0
1250	......	......	1.70	1.50	......	6.40	7.19	6.40	6.0	13.59	12.0	2.21	2.0
1866	......	......	1.00	.75	......	......	3.18	8.68	8.0	11.86	10.0	3.65	3.0
1867	......	......	......	......	......	......	2.82	10.70	10.0	13.52	11.0	3.19	2.0
1247	......	......	1.02	.75	4.09	3.75	4.07	7.84	8.0	11.91	10.0	1.16	1.0
1588	......	......	1.15	.75	1.30	5.17	3.61	6.47	6.0	10.08	8.0	10.98	10.0
1871	......	......	.97	.75	......	......	4.86	6.58	6.0	11.44	9.0	1.76	1.0
1580	......	......	3.33	3.00	6.78	1.85	1.91	8.63	8.0	10.54	10.0	6.55	6.0
1870	......	......	2.51	2.00	......	......	3.21	6.89	6.0	10.10	8.0	6.28	6.0
1388	......	......	3.43	3.25	3.12	2.11	4.26	5.25	6.0	9.49	7.0	9.76	10.0
1391	......	......	2.62	2.50	5.63	1.76	4.70	7.39	6.0	12.09	12.0	10.27	10.0
1869	......	......	2.29	2.25	......	......	3.30	6.96	6.0	10.26	7.0	4.79	4.0
1392	......	......	5.09	5.00	3.52	2.26	3.70	5.78	4.0	9.48	6.0	5.87	6.0
2113	......	......	2.61	......	6.73	4.25	2.18	10.98	11.0	13.16	12.0	3.71	2.4
2112	1.06	2.40	3.46	3.30	5.36	3.32	1.51	8.68	8.0	10.19	9.0	6.91	7.0
1282	......	......	2.59	2.05	6.79	3.18	1.42	9.97	9.0	11.39	10.0	1.68	1.5
2111	.11	1.06	1.17	1.03	5.93	2.35	1.55	8.28	8.0	9.83	9.0	2.32	2.0
1882	......	......	1.00	.82	......	......	1.10	8.56	7.0	9.66	8.0	1.56	1.1
1269	......	......	2.11	2.06	8.39	2.28	.93	10.67	9.0	11.60	11.0	3.07	3.2
1267	......	......	2.61	2.50	5.17	2.14	2.23	7.31	6.0	9.54	8.0	5.43	5.0
1265	......	......	2.70	2.50	7.55	3.58	1.48	11.13	9.0	12.61	11.0	2.27	2.0
1600	......	......	1.43	.82	7.46	1.72	1.61	9.18	7.0	10.79	9.0	2.10	1.0
1217	......	......	2.72	2.47	8.10	1.57	.96	9.67	9.0	10.63	10.0	2.65	2.0
1219	......	......	2.33	1.03	7.18	2.55	1.89	9.73	8.0	11.62	10.0	2.59	2.0
1218	......	......	2.36	1.85	7.38	2.34	1.81	9.72	8.5	11.53	10.0	2.62	2.0
1215	......	......	1.79	1.23	6.52	1.74	1.05	8.26	6.5	9.31	8.0	3.66	3.0
1607	......	......	1.48	1.03	6.71	2.16	2.35	8.87	8.0	11.22	9.0	2.42	2.0
1608	......	......	1.63	.82	6.80	2.39	1.83	9.19	7.0	11.02	9.0	2.00	1.0
1264	......	......	2.16	2.05	8.83	1.64	.97	10.47	8.0	11.44	10.0	3.21	3.0
2109	.11	1.06	1.17	1.03	5.79	2.89	1.27	8.68	8.0	9.95	9.0	2.20	2.0
1263	......	......	2.39	2.05	7.38	2.51	1.92	9.89	9.0	11.81	11.0	2.71	2.0
1901	.30	1.49	1.79	2.00	6.99	2.77	2.66	9.76	9.0	12.42	11.0	1.89	1.8
2117	.28	1.22	1.50	1.23	5.97	2.86	2.67	8.83	8.5	11.50	10.5	2.94	2.5
2118	.25	1.19	1.44	1.20	5.85	2.97	2.60	8.82	8.5	11.42	10.0	2.75	2.5

Descriptive List of Manufacturers' Samples, 1899.

Station number.	Manufacturer, place of business and brand.
2119	E. Frank Coe's Excelsior Potato Fertilizer
1617	E. Frank Coe's Grass and Grain Fertilizer
2116	E. Frank Coe's High Grade Ammoniated Bone Phosphate
1884	E. Frank Coe's High Grade Potato Fertilizer
2120	E. Frank Coe's Prize Brand Grain and Grass Fertilizer
1405	E. Frank Coe's Special Potato Fertilizer
2121	E. Frank Coe's Standard Grade Ammoniated Bone Phosphate
	CROCKER FERTILIZER AND CHEMICAL CO., BUFFALO, N. Y.
1855	Crocker's Ammoniated Corn Phosphate
1853	Crocker's New Rival Ammoniated Superphosphate
1856	Crocker's Potato, Hop and Tobacco Phosphate
1854	Crocker's Superior Fertilizer
	Crocker's Superior Rye and Oats Fertilizer
	CUMBERLAND BONE PHOSPHATE CO., PORTLAND, ME.
1899	Cumberland Bone and Potash
1601	Cumberland Hawkeye Fertilizer
1394	Cumberland Potato Fertilizer
1395	Cumberland Seeding Down Manure
1393	Cumberland Superphosphate
	L. B. DARLING FERTILIZER CO., PAWTUCKET, R. I.
2131	Darling's Animal Anchor Brand
2130	Darling's Animal Fertilizer "G" Brand
2129	Darling's Blood, Bone and Potash
	FRANK S. FARRAR & CO., BANGOR, ME.
1277	Farrar's Potato Manure
1276	Farrar's Superphosphate
	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.
1578	Great Eastern Dissolved Bone
1230	Great Eastern General Fertilizer
1231	Great Eastern Grass and Oats Fertilizer
1233	Great Eastern Northern Corn Special
1232	Great Eastern Potato Manure
	E. L. LEWIS, ATLANTIC, MASS.
2132	Lewis Potato Fertilizer
	LISTER'S AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J.
2105	Lister's Seeding Down Fertilizer
2104	Lister's Special Potato Fertilizer
2103	Lister's Success Fertilizer
2102	Lister's "U. S." Superphosphate
	LOWELL FERTILIZER CO., BOSTON, MASS.
1874	Swift's Lowell Animal Fertilizer
1875	Swift's Lowell Bone Fertilizer
1876	Swift's Lowell Dissolved Bone and Potash
1873	Swift's Lowell Ground Bone
1879	Swift's Lowell Fruit and Vine Fertilizer
1877	Swift's Lowell Potato Phosphate
	NATIONAL FERTILIZER CO., BRIDGEPORT, CONN.
1885	Chittenden's Ammoniated Bone Fertilizer
1886	Chittenden's Complete Root Fertilizer
1887	Chittenden's Market Garden Fertilizer
	SAMUEL G. OTIS, HALLOWELL, ME.
1597	Otis Potato Fertilizer
1880	Otis Seeding Down Fertilizer
1620	Otis Superphosphate
	PACIFIC GUANO CO., BOSTON, MASS.
1605	Pacific Guano Company's Grass and Grain Fertilizer
1604	Pacific Guano Company's Potato Special
1234	Nobsque Guano
1235	Soluble Pacific Guano

ANALYSES OF MANUFACTURERS' SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
			Total.					Available.		Total.			
	As ammonia or nitrates.	As organic.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2119	.65	2.02	2.67	2.50	6.14	1.34	1.27	7.48	8.0	8.75	9.0	9.91	8.0
1617	......	......	2.83	.80	7.88	2.96	3.63	10.84	8.5	14.47	10.0	1.21	1.5
2116	......	....	1.68	1.85	5.97	2.62	2.50	8.95	9.0	11.45	11.0	2.90	2.2
1884	.....	......	2.50	2.40		......	1.29	7.71	7.0	9.00	8.0	7.86	6.5
2120	......	......	....	......	12.30	2.57	.47	14.87	10.5	15.34	12.0	.67	2.0
1405	......	.. .	1.95	1.65	7.43	1.82	4.20	9.25	8.0	13.45	10.0	4.58	4.0
2121	.27	1.26	1.53	1.20	6.32	2.33	2.87	8.65	8.5	11.52	10.0	2.45	2.2
1855	......	......	2.92	2.05	......	......	.58	12.21	10.0	12.79	11.0	2.43	1.6
1853	......	......	2.16	1.23	.....	......	.62	11.75	10.0	12.37	11.0	3.37	1.6
1856	......	......	2.42	2.05	......	......	.77	10.68	10.0	11.45	11.0	3.39	3.2
1854	......	......	.90	.82	.....	......	.83	8.86	8.0	9.69	9.0	2.06	2.0
....	......	......	.90	.82	......	......	.83	8.86	8.0	9.69	9.0	2.06	2.0
1899	......	... ..	.....	......	6.38	3.36	2.08	9.74	8.0	11.82	10.0	3.15	2.5
1601	......	.....	1.70	.82	7.45	1.42	1.90	8.87	7.0	10.77	9.0	2.08	1.0
1394	......	......	2.12	2.06	7.01	1.88	2.16	8.89	9.0	11.05	11.0	3.97	3.0
1395	......	......	1.10	1.03	5.82	1.98	2.11	7.80	8.0	9.91	10.0	2.93	2.0
1393	......	.....	2.08	2.06	5.96	3.36	1.92	9.30	8.0	11.22	10.0	3.56	2.0
2131	.23	2.32	2.55	1.65	5.73	2.69	.71	8.42	6.0	9.13	7.0	3.16	2.0
2130	.23	2.32	2.55	2.06	5.60	2.58	.62	8.18	6.0	8.80	7.0	4.64	4.0
2129	.96	2.84	3.80	4.12	5.50	3.12	.91	8.62	7.0	9.53	8.0	6.37	7.5
1277	......	......	2.33	2.25	3.03	7.19	5.99	10.22	9.0	16.21	12.0	3.32	3.0
1276	......	......	2.56	2.50	3.24	8.26	4.25	11.50	9.0	15.75	12.0	1.63	2.0
1578	......	......	......	.....	9.27	5.86	1.36	15.13	14.0	16.49	......	.. . .	....
1230	......	.....	1.10	.83	.69	9.25	2.26	9.94	8.0	12.20	......	4.72	4.0
1231	......	.. ...	......	......	4.11	6.88	4.08	10.99	11.0	15.07	......	2.15	2.0
1233	......	... ..	3.06	2.88	3.84	5.36	.74	9.20	8.0	9.94	......	3.42	2.0
1232	......	......	2.35	2.06	5.14	4.90	.68	10.04	8.0	10.72	......	5.71	4.0
2132	1.20	2.36	3.56	3.28	3.74	2.40	1.93	6.14	5.0	8.07	6.0	10.43	10.0
2105	.06	.84	.90	.62	7.58	2.64	2.47	10.22	10.0	12.69	11.0	1.06	1.0
2104	.25	1.46	1.71	1.65	5.87	2.52	2.38	8.39	8.0	10.77	9.0	2.94	3.0
2103	.27	1.22	1.49	1.24	7.23	2.33	2.43	9.56	9.5	11.99	11.5	2.06	2.0
2102	.19	1.35	1.54	1.32	5.09	2.34	2.03	7.43	7.0	9.46	8.0	2.39	2.0
1874	......	.....	2.85	2.46	......	......	1.01	10.38	9.0	11.39	10.0	4.10	4.0
1875	......	......	2.06	1.64	.....	......	1.31	8.27	8.0	9.58	9.0	3.56	3.0
1876	......	......	1.90	1.64	.....	......	1.73	9.33	9.0	11.06	10.0	2.45	2.0
1873	......	......	2.30	2.40	.. ...	....	......	......	5.0	27.72	28.0	......	.....
1879	......	.....	3.69	3.28	.....	......	.96	7.72	7.0	8.68	8.0	6.44	6.0
1877	......	. ....	2.61	2.46	.....	......	1.08	9.41	8.0	10.49	9.0	6.96	6.0
1885	......	......	2.42	1.60	......	......	1.61	9.72	9.0	11.33	10.0	3.69	2.0
1886	......	......	3.79	3.30	......	......	1.33	9.35	8.0	10.68	10.0	6.31	6.0
1887	......	......	3.02	2.40	......	......	2.90	7.29	7.0	10.19	9.0	5.83	6.0
1597	......	......	2.06	2.00	8.46	1.98	1.24	10.44	9.0	11.68	11.0	4.12	3.0
1880	......	......	1.36	1.50	.....	......	1.61	8.37	8.0	9.98	12.0	2.39	2.0
1620	......	......	2.57	2.00	6.44	4.72	1.85	11.16	9.5	13.01	11.0	2.77	2.0
1605	......	.....	1.82	.82	6.70	2.71	1.68	9.41	7.0	11.09	8.0	2.39	1.1
1604	......	.....	2.65	2.05	8.88	2.13	1.06	11.01	8.0	12.07	9.0	4.10	3.0
1234	......	......	1.23	1.15	6.23	2.68	2.44	8.91	8.0	11.35	9.0	2.25	2.0
1235	......	.....	2.37	2.25	7.33	2.42	1.85	9.75	8.5	11.60	10.5	2.61	2.0

DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1899.

Station number.	Manufacturer, place of business and brand.
	PACKERS' UNION FERTILIZER CO., NEW YORK, N. Y.
1566	Packers' Union Animal Corn Fertilizer
1567	Packers' Union High Grade Potato Manure
2126	Packers' Union Universal Fertilizer
1619	Packers' Union Wheat, Oats and Clover Fertilizer
	PARMENTER & POLSEY FERTILIZER CO., PEABODY, MASS.
2123	Plymouth Rock Brand
2122	"P. and P." Potato Fertilizer
2124	Parmenter & Polsey Special Potato Fertilizer
2125	Star Brand Superphosphate
	EDWIN J. PHILBRICK, AUGUSTA, ME.
1888	Philbrick's Fertilizer
	PORTLAND RENDERING CO., PORTLAND, ME.
1616	Portland Rendering Co.'s Bone Tankage
	THE QUINNIPIAC CO., BOSTON, MASS.
1589	Quinnipiac Climax Phosphate
1590	Quinnipiac Corn Manure
1244	Quinnipiac Phosphate
1245	Quinnipiac Potato Manure
1591	Quinnipiac Potato Phosphate
1246	Quinnipiac Seeding Down Manure
	READ FERTILIZER CO., SYRACUSE, N. Y.
1396	Read's Practical Potato Special
1397	Read's Standard
1587	Read's Sure Catch
1555	Read's Vegetable and Vine
1865	Sampson Fertilizer
	RUSSIA CEMENT CO., GLOUCESTER, MASS.
1410	Essex Complete Manure for Corn, Grain and Grass
1411	Essex Complete Manure for Potatoes, Roots and Vegetables
2106	Essex Corn Fertilizer
2108	Essex Potato Fertilizer
1568	Essex XXX Fish and Potash
1891	Maine State Grange Chemicals
1892	Maine State Grange Potato Manure
2107	Maine State Grange Seeding Down Fertilizer
	SAGADAHOC FERTILIZER CO., BOWDOINHAM, ME.
1864	Dirigo Fertilizer
1863	Merrymeeting Superphosphate
1902	Sagadahoc Bone Meal
2127	Sagadahoc Special Potato Fertilizer
2128	Sagadahoc Superphosphate
1862	Yankee Fertilizer
	STANDARD FERTILIZER CO., BOSTON, MASS.
1414	Standard "A" Brand
1890	Standard Bone and Potash
1223	Standard Fertilizer
1221	Standard Guano
1603	Standard Special for Potatoes
	HENRY F. TUCKER CO., BOSTON, MASS.
1846	Original Bay State Bone Superphosphate
	JOHN WATSON, HOULTON, ME.
2133	Watson's Improved Potato Manure
	WILLIAMS & CLARK FERTILIZER CO., BOSTON, MASS.
1237	Americus Ammoniated Bone Superphosphate
1594	Americus Corn Phosphate
1595	Americus Potato Manure
1236	Royal Bone Phosphate for All Crops
1629	Williams & Clark Potato Phosphate
	A. F. YOUNG & CO., NEW YORK, N. Y.
2110	Young's Excelsior Potato Fertilizer

ANALYSES OF MANUFACTURERS' SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
1566	.....	......	2.58	2.47	6.18	1.99	2.33	8.17	8.0	10.50	9.0	1.74	2.0
1567	......	......	2.11	2.06	6.50	1.49	1.96	7.99	8.0	9.95	9.0	8.05	6.0
2126	.08	1.02	1.10	.82	6.97	1.73	1.17	8.70	8.0	9.87	9.0	4.92	5.0
1619	.....	...	.25	....	.....	......	1.20	10.92	11.0	12.12	....	2.39	2.0
2123	.21	2.08	2.29	2.47	3.81	4.21	1.38	8.02	8.0	9.40	9.0	4.19	4.0
2122	.46	1.61	2.07	1.64	3.67	3.70	1.12	7.3	6.0	8.49	7.0	5.63	5 5
2124	1.69	1.29	2.98	3.29	4.21	4.27	1.29	8.48	8.0	9.77	9.0	7.41	7.0
2125	1.01	.79	1.80	1.64	3.80	3.54	1.15	7.34	7.0	8.49	8.0	2.60	2.5
1888	.38	1.65	2.03	2.00	2.00	5.19	1.74	7.19	7.0	8.93	9.0	5.58	5.0
1616	......	......	4.27	4.42	.....	7.34	12.06	7.34	......	19.40	18.6	......	....
1589	.....	......	1.28	1.03	4.61	4.02	2.64	8.63	8.0	11.27	9.0	2.54	2.0
1590	....	......	2.22	2.06	9.15	1.24	1.29	10.39	9.0	11.68	10.0	2.27	1.5
1244	......	....	2.74	2.47	7.91	1.47	1.11	9.38	9.0	10.49	10.0	2.72	2.0
1245	......	.....	2.71	2.47	5.85	1.82	2.26	7.67	6.0	9.93	7.0	5.80	5.0
1590	......	......	2.15	2.05	8.78	1.64	.90	10.42	8.0	11.32	9.0	3.66	3.0
1246	......	......	1.23	.82	6.59	2.87	2.26	9.46	9.0	11.72	10.0	2.26	2.0
1396	......	.....	1.20	.82	3.39	1.55	.54	4.94	4.0	5.48	5.0	8.35	8.0
1397	.....	......	1.15	.82	6.50	1.73	.92	8.23	8.0	9.15	9.0	4.33	4.0
1587	......	......	......	......	7.89	1.63	1.56	9 52	6.0	11.08	7.0	5.06	4.0
1555	......	......	1.96	1.65	5.04	1.21	1.55	6.25	6.0	7.80	7.0	7.96	8.0
1865	......	.. ...	1.97	1.65	......	......	1.51	6.75	6.0	8.26	7.0	4.42	4.0
1410	......	.....	4.00	3.70	3.02	6.39	2.51	9.41	7.0	11.92	9.5	10.52	9.5
1411	.....	.....	3.96	3.70	2.60	5.54	2.84	8.14	7.0	10.98	9.0	9.18	8.5
2106	.52	1.72	2.24	2.00	5.31	4.03	4.14	9.34	9.0	13.48	11.0	3.33	3.0
2108	.63	1.55	2.18	2.00	5.50	4.18	4.08	9.68	9.0	13.76	11.0	5.57	5.0
1568	......	.....	2.68	2.10	8.00	2.63	2.56	10.63	9.0	13.19	12.0	2.75	2.25
1891	.82	1.58	2.40	2.50	2.45	5.71	3.89	8.16	8.0	12.05	12.0	4.72	4.0
1892	......	1.02	1.02	1.50	1.34	7.11	3.67	8.45	9.0	12.12	12.0	12.43	12.0
2107	...	1.91	1.91	1.50	3.19	4.24	6.36	7.43	7.0	13.79	13.0	5.69	5.5
1864	......	......	1.85	2.00	......	...	4.82	5.41	3.0	10.23	10.0	5.28	4.0
1863	......	......	1.50	1.50	......	......	3.78	7.72	5.0	11.50	9.0	2.73	2 0
1902	......	3.79	3.79	3.00	......	......	......	......	.....	18.42	20.0	.. ..	......
2127	2.15	.67	2.82	2.40	5.90	2.46	.75	8.36	6.0	9.11	10.0	8.11	7.0
2128	1.11	1.16	2.27	2 10	7.11	2.84	1.18	9.95	6.0	11.13	10.0	4.61	4.0
1862	......	....	.82	.50	......	......	2.12	9.03	3.0	11.15	7.0	2.77	1.5
1414	......	......	1.33	.82	4.84	3.08	1.96	7.92	7.0	9.88	9.0	1.71	1.0
1890	.....	......	......	......	6.94	3.03	1.51	9.97	8.0	11.48	10.0	4.10	2.5
1223	... .	.....	2.44	2.00	7.36	2.64	1.96	10.00	8.0	11.96	10.0	2.67	2.0
1221	.....	......	1.75	1.25	6.59	2.02	1.09	8.61	6.5	9.70	8.5	3.69	3.0
1603	.....	......	2.43	2.05	8.00	2.98	1.03	10.98	8.0	12.01	9.0	3.78	3.0
1846	.....	......	2.40	2.06	.....	......	2.42	9.43	9.0	11.85	11.0	2.69	2.0
2133	.19	2.03	2.22	2.50	3.14	3.85	.84	6.99	6 00	7.83	7.00	6.52	5.00
1237	.....	.....	2.80	2.47	7.85	1.65	.79	9.50	9.0	10.29	10.0	2.63	2.0
1594	.... .	......	2.27	2.06	8.76	.33	2.56	9.09	9.0	11.65	10.0	2.03	1.5
1595	......	.....	2.07	2.06	9.08	.96	1.24	10.04	8.0	11.28	9.0	3.53	3.0
1236	......	.....	1.26	1.03	6.20	3.11	2.23	9.30	7.0	11.54	8.0	2.26	2.0
1629	......	......	2.71	2.47	......	......	2.30	7.86	6.0	10.16	7.0	5.54	5.0
2110	2.22	1.14	3.36	2.88	5.02	.86	.29	5.88	5.5	6.17	.....	12.25	10.0

THE CHIEF PROVISIONS OF THE FERTILIZER LAW APPLYING TO MANUFACTURERS, IMPORTERS AND DEALERS.

The law for the regulation of the sale and analyses of commercial fertilizers makes the following requirements upon manufacturers, importers or dealers who propose to sell or offer for sale commercial fertilizers in the State:

1. *The Brand.* Each package shall bear, conspicuously printed, the following statements:

The number of net pounds contained in each package.
The name or trade mark under which it is sold.
The name of the manufacturer or shipper.
The place of manufacture
The place of business of manufacturer or shipper.
The percentage of nitrogen or its equivalent in ammonia.
The percentage of potash soluble in water.
The percentage of phosphoric acid in available form.
The percentage of total phosphoric acid.

2. *The Certificate.* There shall be filed annually between Nov. 15 and Dec. 15 with the Director of the Station a certificate containing an accurate statement of the brand. This certificate applies to the next succeeding calendar year. (Blanks for this purpose will be furnished on application to the Station.)

3. *Manufacturer's Samples.* There shall be deposited annually, unless excused by the Director under certain conditions, a sample of fertilizer, with an accompanying affidavit that this sample "corresponds within reasonable limits to the fertilizer which it represents."

4. *Analysis fee.* For each brand of fertilizer sold or offered for sale in the state there shall be paid annually to the Director of the Station "an analysis fee as follows: Ten dollars for the phosphoric acid and five dollars each for the nitrogen and potash, contained or said to be contained in the fertilizer."

5. *The license.* Upon receipt of the fee, the certificate and the sample (if required), the Director of the Station "shall issue a certificate of compliance."

[The full text of the law will be sent to those asking for it.]

CHAS. D. WOODS, *Director.*

FEEDING STUFF INSPECTION.

CHAS. D. WOODS.

Samples of the feeding stuffs coming under the inspection law, drawn in November, 1898, were analyzed and the results were published in January, 1899, as bulletin 48 of the Station. The inspectors visited most of the larger dealers again in January. At this time, samples were drawn from goods which had not been previously sampled and the results of the analyses are given in the pages which follow. In addition to the analyses here reported quite a large number of samples sent to the Station by correspondents have been analyzed and the results sent to them. In only one instance have correspondents' samples shown inferior goods and that is discussed below. The results of these analyses are not here reported as they agree substantially with the official samples.

Cotton Seed Meal. During the year about 200 samples of cotton seed meal have been examined, chiefly from the dairy sections of the State including the counties of Hancock, Waldo, Penobscot, Piscataquis and the whole of the State west of the Kennebec. Of these samples, two were low grade, *unguaranteed* goods in Hancock county. Upon writing the dealers calling attention to the violations of the law in selling unbranded goods, they took the necessary steps to conform to the law. Three samples of low grade goods found in Androscoggin and Penobscot counties were from the same wholesale house. The firm claimed that their shipper made a mistake in tagging one of the Androscoggin cotton seed meals and that instead of having tags guaranteeing 43 per cent of protein, the meal should have carried tags guaranteeing 25 per cent. The change of tags were made.

The other Androscoggin and the Penobscot county low grade meal was from the same car. This was one of ten cars bought by the wholesale house. As soon as notified of the inferior quality of the goods the guarantee was changed on the stock in the hands of the retailers and the order for the other cars (not then delivered) was countermanded. The law in this instance not only brought it about that the low grade goods in the State were properly guaranteed, but through its operation a number of cars of low grade cotton seed meal were kept out of the State.

[Continued on page 44.]

MANUFACTURERS AND PLACE OF SAMPLING.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8485	American Cotton Oil Co	Huntsville, Ala	Brownfield
8486	American Cotton Oil Co	Brinkley, Ark	Fryeburg
8487	American Cotton Oil Co	Little Rock, Ark	South Windham
8493	American Cotton Oil Co	Nashville, Tenn	West Falmouth
8505	American Cotton Oil Co	Nashville, Tenn	Lock Mills
8484	American Cotton Oil Co		Camden
8506	American Cotton Oil Co		Dover
8494	The Southern Cotton Oil Co	Memphis, Tenn	Bath
8495	The Southern Cotton Oil Co	Memphis, Tenn	Sebago Lake
8496	The Southern Cotton Oil Co	Memphis, Tenn	Hampden
8497	The Southern Cotton Oil Co	Memphis, Tenn	Bangor
8498	The Southern Cotton Oil Co	Memphis, Tenn	Westbrook
8499	The Southern Cotton Oil Co	Memphis, Tenn	Waldoboro
8500	The Southern Cotton Oil Co	Memphis, Tenn	Brunswick
8625	The Southern Cotton Oil Co	Memphis, Tenn	Phillips
8538	The Southern Cotton Oil Co	Memphis, Tenn	Berwick
8501	The Southern Cotton Oil Co	Newport, Ark	Houlton
8502	The Southern Cotton Oil Co	Newport, Ark	Newport
8503	The Southern Cotton Oil Co	Newport, Ark	Dexter
8504	The Southern Cotton Oil Co	Newport, Ark	Stroudwater
8478	O. Holway & Co		Greene
8617	O. Holway & Co		Readfield
8815	*		Dover
8523	R. B. Brown Oil Co	St. Louis, Mo	Pittsfield
8524	R. B. Brown Oil Co	St. Louis, Mo	Bath
8525		St. Louis, Mo	Dexter
8618		St. Louis, Mo	Norridgewock
8479	Chapin & Co	St. Louis, Mo	Belfast
8509	Chapin & Co	St. Louis, Mo	Milo
8510	Chapin & Co	St. Louis, Mo	Bangor
8511	Chapin & Co	St. Louis, Mo	Newport
8512	Chapin & Co	St. Louis, Mo	Belfast
8513	Chapin & Co	St. Louis, Mo	Portland
8514	Chapin & Co	St. Louis, Mo	Orrington
8541	Chapin & Co	St. Louis, Mo	North Fayette
8488	F. W. Brodé & Co	Memphis, Tenn	Hiram
8489	F. W. Brodé & Co	Memphis, Tenn	Cornish
8490	F. W. Brodé & Co	Memphis, Tenn	Richmond
8491	F. W. Brodé & Co	Memphis, Tenn	Dexter
8492	F. W. Brodé & Co	Memphis, Tenn	Winterport
8507	F. W. Brodé & Co	Memphis, Tenn	Westbrook
8508	F. W. Brodé & Co	Memphis, Tenn	East Poland
8619	F. W. Brodé & Co	Memphis, Tenn	Norridgewock
8645	F. W. Brodé & Co	Memphis, Tenn	Bethel
8650	F. W. Brodé & Co	Memphis, Tenn	Albion
8519	*		Norway
8520	*		Bangor
8521	*		Bucksport

* Brand incomplete. Name of manufacturer and place of business not given.

ANALYSES OF SAMPLES.

Name of Feed.	Protein.		Fat.		Station Number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Prime Cotton Seed Meal	43.44	43.00	9.64	9.00	8485
Prime Cotton Seed Meal	40.25	43.00	10.27	9.00	8486
Prime Cotton Seed Meal	45.50	43.00	9.86	9.00	8487
Prime Cotton Seed Meal	45.00	43.00	10.39	9.00	8493
Prime Cotton Seed Meal	45.69	43.00	10.54	9.00	8505
Prime Cotton Seed Meal	46.00	43.00	9.96	9.00	8484
Prime Cotton Seed Meal	45.63	43.00	11.01	9.00	8506
Prime Finely Ground Cotton Seed Meal	41.38	43.00	11.32	9.00	8494
Prime Finely Ground Cotton Seed Meal	42.50	43.00	10.51	9.00	8495
Prime Finely Ground Cotton Seed Meal	43.13	43.00	12.21	9.00	8496
Prime Finely Ground Cotton Seed Meal	44.19	43.00	12.38	9.00	8497
Prime Finely Ground Cotton Seed Meal	42.81	43.00	12.26	9.00	8498
Prime Finely Ground Cotton Seed Meal	42.88	43.00	11.55	9.00	8499
Prime Finely Ground Cotton Seed Meal	42.88	43.00	11.39	9.00	8500
Prime Finely Ground Cotton Seed Meal	46.50	43.00	10.58	9.00	8625
Prime Finely Ground Cotton Seed Meal	44.06	43.00	12.02	9.00	8538
Prime Finely Ground Cotton Seed Meal	45.25	41.00	10.48	9.00	8501
Prime Finely Ground Cotton Seed Meal	45.63	41.00	11.46	9.00	8502
Prime Finely Ground Cotton Seed Meal	45.50	41.00	10.63	9.00	8503
Prime Finely Ground Cotton Seed Meal	45.13	41.00	10.62	9.00	8504
Prime Memphis Cotton Seed Meal	24.44	25.50	7.35	5.71	8478
Prime Memphis Cotton Seed Meal	23.94	25.50	6.60	5.71	8617
Prime Memphis Cotton Seed Meal	45.13	43.00	13.49	9.00	8515
Prime Cotton Seed Meal	44.56	43.00	13.61	9.00	8523
Prime Cotton Seed Meal	45.75	43.00	12.83	9.00	8524
Prime Cotton Seed Meal	23.31	43.00	6.57	9.00	8525
Prime Cotton Seed Meal	22.38	43.00	6.77	9.00	8618
Cotton Seed Meal	42.50	43.00	10.06	9.00	8479
Cotton Seed Meal	45.50	43.00	9.25	9.00	8509
Cotton Seed Meal	45.25	43.00	10.10	9.00	8510
Cotton Seed Meal	44.81	43.00	10.44	9.00	8511
Cotton Seed Meal	42.38	43.00	9.37	9.00	8512
Cotton Seed Meal	42.63	43 00	11.02	9.00	8513
Cotton Seed Meal	45.06	43.00	9.54	9.00	8514
Cotton Seed Meal	44.25	43.00	10.23	9.00	8541
Owl Brand Cotton Seed Meal	43.50	43.00	12.89	9.00	8488
Owl Brand Cotton Seed Meal	45.13	43.00	9.38	9.00	8489
Owl Brand Cotton Seed Meal	45.63	43.00	13.40	9.00	8490
Owl Brand Cotton Seed Meal	43.94	43.00	10.98	9.00	8491
Owl Brand Cotton Seed Meal	48.69	43.00	10.31	9.00	8492
Owl Brand Cotton Seed Meal	45.50	43.00	9.96	9.00	8507
Owl Brand Cotton Seed Meal	45.06	43.00	10.15	9.00	8508
Owl Brand Cotton Seed Meal	44.81	43.00	10.73	9.00	8619
Owl Brand Cotton Seed Meal	42.80	43.00	10.19	9.00	8645
Owl Brand Cotton Seed Meal	45.44	43.00	10.34	9.00	8650
"Daisy Brand" Cotton Seed Meal	45.06	43.00	9.42	9.00	8519
"Daisy Brand" Cotton Seed Meal	42.88	43.00	14.08	9.00	8520
"Daisy Brand" Cotton Seed Meal	45.88	43.00	9.86	9.00	8521

MANUFACTURERS—Continued.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8522	*		Portland
8643	*		Rumford
8482	D. M. Hawkins & Co	Memphis, Tenn	Bowdoinham
8483	D. M. Hawkins & Co	Memphis, Tenn	Portland
8624	D. M. Hawkins & Co	Memphis, Tenn	Farmington
8516	Hunter Bros		Dexter
8517	Hugh Petit & Co		Mechanic Falls
8526	J. E. Soper & Co.		Yarmouth
8527	J. E. Soper & Co.		Corinna
8529	J. E. Soper & Co		Mechanic Falls
8528	Dyersburg Oil & Fertilizer Co.	Dyersburg, Tenn	Belfast
8536	Dyersburg Oil & Fertilizer Co.	Dyersburg, Tenn	South Berwick
8539	Doten Grain Co		Waterboro
8530	*		Steep Falls
8531	*		Dexter
8534	*		Portland
8537	*		Springvale
8518	*		West Peru
8626	*		Wilton
8653	*		Augusta
8623	*		Winthrop
8622	*		Lewiston
8621	*		Livermore Falls
8620	*		North Anson
8532	*		Gorham
8533	*		South Paris
8644	*		Hartford
8481	*		Orland
8542	The Glucose Sugar Refining Co.		Richmond
8548	The Glucose Sugar Refining Co.		Belfast
8554	The Glucose Sugar Refining Co.		Camden
8544	The Glucose Sugar Refining Co.		Hampden
8551	The Glucose Sugar Refining Co.		East Poland
8543	The Glucose Sugar Refining Co.		Portland
8545	The Glucose Sugar Refining Co.		Bucksport
8546	The Glucose Sugar Refining Co.		Orrington
8547	The Glucose Sugar Refining Co.		Winterport
8549	The Glucose Sugar Refining Co.		Bangor
8550	The Glucose Sugar Refining Co.		Pittsfield
8552	The Glucose Sugar Refining Co.		Norway
8553	The Glucose Sugar Refining Co.		Dover
8630	The Glucose Sugar Refining Co.		Lewiston
8555	Charles Pope Glucose Co		Brunswick
8856	Charles Pope Glucose Co		Gorham
8857	Charles Pope Glucose Co		Bath
8858	Charles Pope Glucose Co		Portland
8859	Charles Pope Glucose Co		Wiscasset
8860	Charles Pope Glucose Co		Saco

* Brand incomplete. Name of manufacturer and place of business not given.

ANALYSES—Continued.

Name of Feed.	Protein.		Fat.		Station Number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
"Daisy Brand" Cotton Seed Meal	45.38	43.00	10.32	9.00	8522
"Daisy Brand" Cotton Seed Meal	45.31	43.00	10.41	9.00	8643
Cotton Seed Meal	44.81	43.00	10.64	9.00	8482
Cotton Seed Meal	43.38	43 00	10.57	9.00	8483
Cotton Seed Meal	42.63	43.00	11.07	9.00	8624
Cotton Seed Meal	45.13	43.00	9.36	9.00	8516
Cotton Seed Meal	48.38	43.00	8.03	10.00	8517
Cotton Seed Meal	43.69	43.00	10.73	9.00	8526
Cotton Seed Meal	44.44	43.00	11.33	9.00	8527
Cotton Seed Meal	41.19	43.00	11.65	9.00	8529
Cotton Seed Meal	45.56	43.00	9.54	9.00	8528
Cotton Seed Meal	43.81	43.00	9.04	9.00	8536
Cotton Seed Meal	43.69	43.00	12.16	9.00	8539
Cotton Seed Meal	46.19	43.00	9.81	9.00	8530
Cotton Seed Meal	46.81	43.00	11.59	9.00	8531
Cotton Seed Meal	44.94	43.00	10.49	9.00	8534
Cotton Seed Meal	43.06	43.00	13.33	9.00	8537
Cotton Seed Meal	46.69	43.00	9.21	9.00	8518
Cotton Seed Meal	46.50	43.00	9.97	9.00	8626
Cotton Seed Meal	44.56	43.00	14.46	9.00	8653
Cotton Seed Meal	44.81	46.12	10.34	9.20	8623
Cotton Seed Meal	43.75	46.12	11.79	9.20	8622
Cotton Seed Meal	44.19	46.12	12.24	9.20	8621
Cotton Seed Meal	42.81	46.12	10.68	9.20	8620
Cotton Seed Meal	43.38	....	60.69	....	8532
Cotton Seed Meal	44.31	....	9.79	....	8533
Cotton Seed Meal	42.56	....	10.26	....	8644
Cotton Seed Meal	26.63	....	7.56	....	8481
Chicago Gluten Meal	37.44	38.00	3.27	2.00	8542
Chicago Gluten Meal	36.69	38.00	2.65	2.00	8548
Chicago Gluten Meal	37.19	38.00	3.02	2.00	8554
Chicago Gluten Meal	36.75	38.00	3.07	2.00	8544
Chicago Gluten Meal	38.81	38.00	2.75	2.00	8551
Chicago Gluten Meal	38.31	38.00	3.13	2.00	8543
Chicago Gluten Meal	34.50	38.00	3.61	2.00	8545
Chicago Gluten Meal	35.69	38.00	2.73	2.00	8546
Chicago Gluten Meal	38.06	38.00	3.36	2.00	8547
Chicago Gluten Meal	38.94	38.00	2.27	2.00	8549
Chicago Gluten Meal	37.94	38.00	2.71	2.00	8550
Chicago Gluten Meal	37.44	38.00	3.17	2.00	8552
Chicago Gluten Meal	38.25	38.00	3.27	2.00	8553
Chicago Gluten Meal	37.88	38.00	3.16	2.00	8630
Cream Gluten Meal	32.63	37.12	4.91	3.20	8555
Cream Gluten Meal	35.25	37.12	3.12	3.20	8551
Cream Gluten Meal	34.56	37.12	4.65	3.20	8557
Cream Gluten Meal	33.56	37.12	4.84	3.20	8558
Cream Gluten Meal	32.19	37.12	4.39	3.20	8559
Cream Gluten Meal	30.13	37.12	1.84	3.20	8560

MANUFACTURERS—Continued.

Station Number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8633	Charles Pope Glucose Co		Lewiston
8562	National Starch Manf'g Co	Indianapolis, Ind.	Bowdoinham
8568	National Starch Manf'g Co	Indianapolis, Ind.	Milo
8569	National Starch Manf'g Co	Indianapolis, Ind.	Foxcroft
8563	National Starch Manf'g Co	Des Moines, Ia.	Old Town
8561	National Starch Manf'g Co	Des Moines, Ia.	Sebago Lake
8564	National Starch Manf'g Co	Des Moines, Ia.	Brunswick
8565	National Starch Manf'g Co	Des Moines, Ia.	Dexter
8567	National Starch Manf'g Co	Des Moines, Ia.	Norway
8629	National Starch Manf'g Co	Des Moines, Ia.	Livermore Falls
8566	National Starch Manf'g Co	Des Moines, Ia.	Steep Falls
8627	National Starch Manf'g Co	Des Moines, Ia.	Bingham
8628	National Starch Manf'g Co	Des Moines, Ia.	Winthrop
8570	The Glucose Sugar Refining Co.		South Paris
8571	The Glucose Sugar Refining Co.		West Paris
8572	The Glucose Sugar Refining Co.		Guilford
8573	The Glucose Sugar Refining Co.		Damariscotta
8631	The Glucose Sugar Refining Co.		Farmington
8632	The Glucose Sugar Refining Co.		Readfield Depot
8574	International Milling Co		Brunswick
8575	International Milling Co		Richmond
8634	International Milling Co		Lewiston
8576	The Cleveland Linseed Oil Co.		Brownfield
8648	Mayflower Mills	Fort Wayne, Ind.	Bath
8577	E. W. Blatchford & Co	Chicago, Ill	Brunswick
8587	American Cereal Co		Belfast
8588	American Cereal Co		Bowdoinham
8589	American Cereal Co		Bangor
8590	American Cereal Co		Bucksport
8591	American Cereal Co		Portland
8592	American Cereal Co		Foxcroft
8593	American Cereal Co		Island Falls
8594	American Cereal Co		Bethel
8595	American Cereal Co		Waldoboro
8636	American Cereal Co		Farmington
8637	American Cereal Co.		Bingham
8596	S. A. & J. H. True Co		Bath
8597	S. A. & J. H. True Co		Portland
8598	Commercial Milling Co		Ashland
8599	David Oliver	Joliet, Ill	Fryeburg
8600	The H-O Co	Buffalo, N. Y	Bowdoinham
8601	The H-O Co	Buffalo, N. Y	South Windham
8602	The H-O Co	Buffalo, N. Y	Portland
8635	The H-O Co	Buffalo, N. Y	Phillips
8639			Winthrop
8603	The H-O Co	Buffalo, N. Y	North Yarmouth
8604	The H-O Co	Buffalo, N. Y	North Yarmouth
8605	The H-O Co	Buffalo, N. Y	North Yarmouth

ANALYSES—Continued.

Name of Feed.	Protein.		Fat.		Station number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Cream Gluten Meal	34.31	37.12	3.91	3.20	8633
King Gluten Meal	35.31	32.00	4.07	16.00	8562
King Gluten Meal	34.50	32.00	6.78	16.00	8568
King Gluten Meal	36.25	32.00	6.17	16.00	8569
King Gluten Meal	32.06	32.00	15.90	16.00	8563
King Gluten Meal	32.88	32.00	16.38	16.00	8561
King Gluten Meal	33.88	32.00	16.91	16.00	8564
King Gluten Meal	33.19	32.00	16.46	16.00	8565
King Gluten Meal	33.94	32.00	14.50	16.00	8567
King Gluten Meal	33.75	32.00	16.79	16.00	8629
King Gluten Meal	34.94	34.26	15.71	14.65	8566
King Gluten Meal	32.06	32.00	15.84	9.00	8627
King Gluten Meal	32.38	32.00	12.89	12.00	8628
Buffalo Gluten Feed	27.00	25.50	4.00	4.00	8570
Rockford Diamond Gluten Feed	24.56	24.20	4.54	3.76	8571
Rockford Diamond Gluten Feed	25.25	24.20	4.16	3.76	8572
Rockford Diamond Gluten Feed	21.31	24.20	5.02	3.76	8573
Rockford Diamond Gluten Feed	25.31	24.20	5.03	3.76	8631
Rockford Diamond Gluten Feed	25.25	24.20	4.67	3.76	8632
Sucrene Oil Meal	26.44	24.75	3.33	3.50	8574
Sucrene Oil Meal	23.63	24.75	3.26	3.50	8575
Sucrene Oil Meal	26.44	24.75	3.44	3.50	8634
Cleveland Flax Meal	37.00	39.00	3.03	1.50	8576
Old Process Linseed Meal	25.44	....	8.92	....	8648
Blatchford's Calf Meal	24.94	....	4.41	....	8577
Victor Corn and Oat Feed	11.25	9.46	4.65	3.92	8587
Victor Corn and Oat Feed	10.69	9.46	4.78	3.92	8588
Victor Corn and Oat Feed	8.63	9.46	3.44	3.92	8589
Victor Corn and Oat Feed	8.75	9.46	3.72	3.92	8590
Victor Corn and Oat Feed	8.56	9.46	3.80	3.92	8591
Victor Corn and Oat Feed	9.13	9.46	3.82	3.92	8592
Victor Corn and Oat Feed	9.63	9.46	4.63	3.92	8593
Victor Corn and Oat Feed	7.81	9.46	3.23	3.92	8594
Victor Corn and Oat Feed	10.38	9.46	5.12	3.92	8595
Victor Corn and Oat Feed	8.56	9.46	3.68	3.92	8636
Victor Corn and Oat Feed	9.69	9.46	3.66	3.92	8637
Corn and Oat Feed	9.13	9.63	3.42	4.23	8596
Corn and Oat Feed	9.19	9.63	3.39	4.23	8597
Ground Corn and Oats	9.44	....	2.89	....	8598
Lakeside Corn and Oat Feed	8.44	9.50	3.24	3.75	8599
Dundee Corn and Oat Feed	8.88	8.38	3.30	2.95	8600
Dundee Corn and Oat Feed	9.00	8.38	3.11	2.95	8601
Dundee Corn and Oat Feed	8.19	8.38	2.69	2.95	8602
Dundee Corn and Oat Feed	9.25	8.38	3.67	2.95	8635
Monarch Corn and Oat Feed	12.31	10.25	7.12	7.49	8639
The H-O Co.'s Standard Dairy Feed	16.50	18.75	4.48	7.25	8603
The H-O Co.'s Horse Feed	11.00	12.30	4.42	4.90	8604
The H-O Co.'s Poultry Feed	17.31	16.80	5.62	7.00	8605

MANUFACTURERS—Concluded.

Station number.	Manufacturer or Jobber.	Manufactured at	Sampled at
8606	The H-O Co	Buffalo, N. Y.	Bowdoinham
8607	The American Cereal Co		Brunswick
8608	The American Cereal Co		North Yarmouth
8609	The American Cereal Co		Westbrook
8610	The American Cereal Co		Richmond
8611	The American Cereal Co		Bath
8612	The American Cereal Co		Portland
8613	The American Cereal Co		Belfast
8614	The American Cereal Co		Foxcroft
8615	The American Cereal Co		Waldoboro
8616	W. H. Haskell & Co.	Toledo, O.	West Falmouth
8638	Andrew Cullen		Madison
8480	Northwestern Fertilizer Co		Portland
8585	Northwestern Fertilizer Co.		Winterport
8578	Bradley Fertilizer Co.		Bangor
8579	Bradley Fertilizer Co		Portland
8583	Bowker Fertilizer Co	Boston, Mass.	Portland
8580	Bowker Fertilizer Co.	Boston, Mass	Bangor
8581	Bowker Fertilizer Co	Boston, Mass	Portland
8582	Bowker Fertilizer Co	Boston, Mass	Waldoboro
8584	B. Randall	East Boston, Mass.	Bowdoinham
8586	American Fertilizer Co.		Bowdoinham

[Continued from page 37.]

In March a correspondent in Cumberland county sent a sample of very low grade cotton seed meal to the Station. This was one of two cars brought into the State by a wholesale house. As soon as their attention was called to the matter, the sale of the meal was stopped, that in the hands of the retailer was returned to them and together with the other car was sold into New Hampshire, which State is not protected by a law regulating the sale of feeding stuffs. This lot of meal was one of the poorest examined by the Station, and probably occasioned considerable loss from the shrinkage of milk flow as nearly a carload of it was sold in two towns before its poor quality was known. Much of the meal was fine and of fairly good appearance. The dealers claim that it has a *commercial* value equal to high grade cotton seed meal as fineness and brightness determine that. The meal had an *agricultural* value of less than one-half its guarantee.

In none of the above instances was there any evident intention of fraud. The dealers as soon as notified, and without wait-

ANALYSES—Concluded.

Name of Feed.	Protein.		Fat.		Station number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
The H-O Co.'s Poultry Feed	17.44	16.80	5.87	7.00	8606
American Cereal Co.'s Poultry Food	13.44	....	5.79	....	8607
American Cereal Co.'s Poultry Food	13.69	....	5.93	....	8608
Quaker Oat Feed	9.25	12.03	3.99	3.49	8609
Quaker Oat Feed	9.63	12.03	3.08	3.49	8610
Quaker Oat Feed	8.94	12.03	3.46	3.49	8611
Quaker Oat Feed	10.75	12.03	3.77	3.49	8612
Quaker Oat Feed	10.81	12.03	4.00	3.49	8613
Quaker Oat Feed	7.75	12.03	3.04	3.49	8614
Quaker Oat Feed	11.69	12.03	4.30	3.49	8615
Haskell's Oat Feed	9.50	9.62	6.51	7.66	8616
Crescent Oat Feed	7.81	10.90	2.99	3.70	8638
Horse Shoe Brand Ground Beef Cracklings for Poultry	64.63	60.00	19.61	16.00	8480
Horse Shoe Brand Ground Beef Cracklings for Poultry	66.44	60.00	16.95	16.00	8585
Bradley's Superior Meat Meal	52.25	40.00	9.40	15.00	8578
Bradley's Superior Meat Meal	53.94	40.00	9.48	15.00	8579
Bowker's Pure Beef Scraps	51.88	....	14.89	....	8583
Bowker's Animal Meal	42.13	30.00	12.45	5.00	8580
Bowker's Animal Meal	46.94	30.00	10.69	5.00	8581
Bowker's Animal Meal	39.69	30.00	11.21	5.00	8582
Pure Beef Scraps	47.44	....	23.08	....	8584
American Poultry Meal	38.06	....	22.44	....	8586

ing for an official notice from the Secretary of Agriculture, either stopped the sale of the goods, or made a guarantee corresponding to the facts. Although the law did not keep these goods out of the State, it has completely prevented their being knowingly sold.

To avoid this class of goods, dealers and consumers should use only reliable brands of cotton seed meal and should send samples of all goods to the Station for free analysis as offered on the last page of this bulletin.

Gluten Meal. With one exception, Chicago Gluten Meal was well up to guarantee in protein. The manufacturers are not sending the Indianapolis King Gluten into the State at present. The Des Moines King Gluten is well up to guarantee. The Chas. Pope Glucose Co.'s Cream Gluten meal continues to fall below the guarantee. Unless the quality is changed for the better, the consumer cannot count on Cream Gluten Meal to carry more than 33 per cent protein.

SUMMARY OF ANALYSES.

	Number of analyses.		PROTEIN.		FAT.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
American Cotton Oil Co.'s Prime Cotton Seed Meal.		Highest	46.00	....	11.01	
	7	Lowest	40.25	43.00	9.64	9.00
		Average	44.50	....	10.24	
Southern Cotton Oil Co.'s Prime Finely Ground Cotton Seed Meal, Memphis, Tenn., Mill.		Highest	46.50	....	12.38	
	9	Lowest	41.38	43.00	10.51	9.00
		Average	43.37	... .	11.58	
Southern Cotton Oil Co.'s Prime Finely Ground Cotton Seed Meal, Newport, Ark., Mill.		Highest	45.63	....	11.46	
	4	Lowest	45.13	41.00	10.48	9.00
		Average	45.38	....	10.80	
O. Holway & Co.'s Prime Memphis Cotton Seed Meal.		Highest	24.44	....	7.35	
	2	Lowest	23.94	25.50	6.60	5.71
		Average	24.19	... .	6.98	
Manufacturer unknown. Prime Memphis Cotton Seed Meal.	1	....	45.13	43.00	13.49	9.00
R. B. Brown Oil Co.'s Prime Cotton Seed Meal.		Highest	45.75	....	13.61	
	2	Lowest	44.56	43.00	12.83	9.00
		Average	45.66	....	13.22	
Chapin & Co.'s Cotton Seed Meal.		Highest	45.50	....	11.02	
	8	Lowest	42.38	43.00	9.25	9.00
		Average	44.05	....	10.00	
F. W. Brodé & Co.'s Owl Brand Cotton Seed Meal.		Highest	48.69	....	13.40	
	10	Lowest	42.80	43.00	9.38	9.00
		Average	45.06	....	10.83	
"Daisy Brand" Cotton Seed Meal.		Highest	45.88	....	14.08	
	5	Lowest	42.88	43.00	9.42	9.00
		Average	44.90	....	10.82	
D. M. Hawkins & Co.'s Cotton Seed Meal.		Highest	44.81	....	11.07	
	3	Lowest	42.63	43 00	10.57	9 00
		Average	43.61	....	10.76	
Hunter Bros.' Cotton Seed Meal.	1	....	45.13	43.00	9.36	9.00
Hugh Petit & Co.'s Cotton Seed Meal.	1	....	48.38	43.00	8.03	10.00
J. E. Soper & Co.'s Cotton Seed Meal.		Highest	44.44	....	11.65	
	3	Lowest	41.19	43.00	10.73	9.00
		Average	43.11	....	11.27	
Dyersburg Oil & Fertilizer Co.'s Cotton Seed Meal.		Highest	45.56	....	9.54	
	2	Lowest	43.81	43.00	9.04	9.00
		Average	44.69	....	9.21	
Doten Grain Co.'s Cotton Seed Meal.	1	....	43.69	43.00	12.16	9.00
Manufacturers unknown. Cotton Seed Meal.		Highest	46.81	....	14.46	
	7	Lowest	43.06	43.00	9.21	9.00
		Average	45.54	....	11.27	
Manufacturers unknown. Cotton Seed Meal.		Highest	44.81	....	12.24	
	4	Lowest	42.81	46.12	10.34	9.20
		Average	43.89	....	11.26	

SUMMARY OF ANALYSES—Continued.

	Number of analyses.		Protein.		Fat.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
The Glucose Sugar Refin'g Co.'s Chicago Gluten Meal.	14	Highest	38.94	38.00	3.61	2.00
		Lowest	34.50		2.27	
		Average	37.42		3.01	
Charles Pope Glucose Co.'s Cream Gluten Meal.	7	Highest	35.25	37.12	4.91	3.20
		Lowest	30.13		1.84	
		Average	33.23		3.95	
National Starch Manf'g Co.'s King Gluten Meal, Indianapolis, Ind., Mill.	3	Highest	36.25	32.00	6.78	16.00
		Lowest	34.50		5.67	
		Average	35.35		8.35	
National Starch Manf'g Co.'s King Gluten Meal, Des Moines, Iowa, Mill.	8	Highest	34.94	32.00	16.91	16.00
		Lowest	32.06		12.89	
		Average	33.28		15.63	
The Glucose Sugar Refin'g Co.'s Buffalo Gluten Feed.	1		27.00	25.50	4.00	4.00
The Glucose Sugar Refin'g Co.'s Rochford Diamond Gluten Feed.	5	Hihgest	25.31	24.20	5.03	3.76
		Lowest	21.31		4.16	
		Average	24.34		4.69	
International Milling Co.'s Sucrene Oil Meal.	3	Highest	26.44	24.75	3.44	3.50
		Lowest	23.63		3.26	
		Average	25.50		3.34	
The Cleveland Linseed Oil Co.'s Cleveland Flax Meal.	1		37.00	39.00	3.03	1.50
Mayflower Mills Old Process Linseed Meal.	1		25.44		8.92	
E. W. Blatchford & Co.'s Blatchford's Calf Meal.	1		24.94		4.41	
American Cereal Co.'s Victor Corn and Oat Feed.	11	Highest	11.25	9.46	5.12	3.92
		Lowest	8.56		3.23	
		Average	9.37		4.05	
S. A. & J. H. True Co.'s Corn and Oat Feed.	2	Highest	9.19	9.63	3.42	4.23
		Lowest	9.13		3.39	
		Average	9.16		3.41	
Commercial Milling Co.'s Ground Corn and Oats.	1		9.44		2.89	
David Oliver's Lakeside Corn and Oat Feed.	1		8.44	9.50	3.24	3.75
The H-O Co.'s Dundee Corn and Oat Feed.	4	Highest	9.25	8.38	3.67	2.95
		Lowest	8.19		2.69	
		Average	8.83		3.19	
Monarch Corn and Oat Feed.	1		12.31	10.25	7.12	7.49
The H-O Co.'s Standard Dairy Feed.	1		16.50	18.75	4 48	7.25
The H-O Co.'s Horse Feed.	1		11.00	12.30	4.42	4.90
The H-O Co.'s Poultry Feed.	2	Highest	17.44	16.80	5.87	7.00
		Lowest	17.31		5.62	
		Average	17.38		5.75	

SUMMARY OF ANALYSES—Concluded.

	Number of analyses.		PROTEIN.		FAT.	
			Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.
The American Cereal Co.'s Poultry Food.	2	Highest	13.69	....	5.93	
		Lowest	13.44	....	5.79	
		Average	13.57	....	5.86	
The American Cereal Co.'s Quaker Oat Feed.	7	Highest	11.69	....	4.30	3.49
		Lowest	7.75	12.03	3.04	
		Average	9.83	....	3.66	
W. H. Haskell & Co.'s Haskell's Oat Feed.	1	....	9.50	9.62	6.51	7.66
Andrew Cullen's Crescent Oat Feed.	1	....	7.81	10.90	2.99	3.70
Northwestern Fertilizer Co.'s HorseShoeBrand Ground Beef Crackings for Poultry.	2	Highest	66.44	....	19.61	16.00
		Lowest	64.63	60.00	16.95	
		Average	65.54	....	18.28	
Bradley Fertilizer Co.'s Bradley's Superior Meat Meal	2	Highest	53.94	....	9.48	15.00
		Lowest	52.25	40.00	9.40	
		Average	53.10	....	9.44	
Bowker Fertilizer Co.'s Bowker's Pure Beef Scraps.	1	....	51.88	....	14.89	
Bowker Fertilizer Co.'s Bowker's Animal Meal.	3	Highest	46.94	....	12.45	5.00
		Lowest	39.69	30 00	10.69	
		Average	42.92	....	11.45	
B. Randall's Pure Beef Scraps.	1	....	47.44	....	23.08	
American Fertilizer Co.'s American Poultry Meal.	1	....	38.06	....	22.44	

[Blank for forwarding samples of feeding stuffs for free analysis.]

....................189....

(Do not write here.)

Station No.......... Chas. D. Woods, Director
Received........... Agricultural Experiment Station,
Orono, Maine.

SIR: I send you to-day, by mail, a fair sample of a feeding stuff. In addition to the red tax tag each package carried the following statements.

(In case these statements are on a tag, it can be sent instead of a copy of the statement.)

Name of goods ....
Name of Manufacturer ....
Per cent. protein............. Per cent. fat...............

The sample was taken by me in accordance with the directions on the back of this sheet, and fairly represents the stock from which it was drawn.

Signature,..................................
Post Office address,.........................

Witness:* The above-described sample was taken in my presence.

Signature of Witness,...........................
Name of Dealer,................................
Address, ...

---

* The witness should be the dealer or his representative, a postmaster, or town or city officer.

FREE ANALYSIS OF FEEDING STUFFS.

The Station officers take pains to obtain for analysis samples of all feeding stuffs coming under the law, but the co-operation of consumers is essential for the full and timely protection of their interests. Whenever anyone believes that this law is being evaded in any way, he is requested to notify the Director of the Station.

The Station will promptly analyze samples of feeding stuffs taken in accordance with the following directions and report the results to the interested parties. Dealers and consumers are urged to avail themselves of this offer.

DIRECTIONS FOR SAMPLING.

The sample should fairly represent the feeding stuff and is best obtained as follows:

Open one or more full and unbroken packages, and mix well together the contents of each for a foot in depth, take out three cupfuls from different parts of the mixed portions of each package, pour them one over another upon a paper, intermix thoroughly and fill a tin spice or baking powder box from the mixture. Detach this leaf, fill out the blank on the opposite side, securely wrap the box and blank in paper and send by mail to the

Agricultural Experiment Station,
Orono, Maine.

THE SPRAYING OF PLANTS.

W. M. MUNSON.

LET US SPRAY.

"It is conservatively estimated that the annual yield of all crops is lessened about 25 per cent. by the attacks of injurious insects and fungous diseases. Experiments have demonstrated that at least 75 per cent. of this loss can be prevented by the use of simple remedies applied by means of a spray pump. Expressed in figures, the annual loss would represent about $500,000,000 in the United States alone. Of this amount, 75 per cent., or $375,000,000 can be saved by spraying."*

The above paragraph represents the facts concerning the importance of spraying, at the present time. Previous reports † have detailed the experiments made along this line at this Station, and equally striking results have been obtained at other stations. Spraying has ceased to be an experiment. The beneficial results obtained at the experiment stations have been fully corroborated in practical field work, and now it is important to know the *how* and the *why* of spraying. In other words, in order that the best results may be obtained, spraying must be done intelligently.

Success in spraying, as in most of the work in life, is largely a matter of detail. Little things, seemingly unimportant, all affect the results obtained. Failure may usually be attributed to lateness of application, carelessness in applying or in preparing the material, or to defective apparatus.

WHY SPRAY?

Spraying is plant insurance. It is, with few exceptions, a *preventive* measure for many of the ills that plants are heir to, and *not* a cure. There are several distinct classes of enemies that must be met, each in a different way. These enemies may be grouped first under the two general heads,—insects and fungi.

---

* Weed, Spraying for Profit, p. 9.

† Rep. Maine Expt. Sta., 1891, p. 99; 1892, p. 92; 1893, p. 124.

The insect enemies are naturally divided into distinct classes which must be met in very different ways, and the same is true of the fungi. The first class of insect enemies includes those that, either in the mature form or as larvæ, eat the plant tissue; e. g., the plum curculio, the codling moth, the currant worm, the tent-caterpillar, the potato beetle, etc. These are very readily destroyed by the application of some form of arsenic, as Paris green, to the parts which will be eaten.

Another class of insects, e. g., the plant lice and some of the scale insects, obtain their food by sucking the juices of the plant and, therefore, are not affected by an application of poison. These must be overcome by an external irritant, such as kerosene, or an alkali like caustic soda or strong soap suds, or by some material that will close the breathing pores and thus stop respiration, e. g., pyrethrum or hellebore (in the dry form hellebore acts in both ways.)

Fungi (singular, *fungus*) are simply low forms of plant life which feed upon organic matter, either living or dead. Those which grow on living tissues—*parasitic fungi*—are the ones with which we are specially concerned. It is these which cause many of the blights and rusts, and smuts and scabs and mildews of various plants. Fungi are propagated by means of minute, microscopic bodies, called spores, which are carried from place to place by the wind and by insects, birds and other animals. A spore, falling upon the surface of a leaf, or the growing tip of a branch, if in the presence of moisture and the usual summer temperature, germinates in a manner very similar to that of a seed. If the surface of the leaf or fruit is coated with some material which is destructive to the young fungus, as the spore germinates, all the damage from the parasite is warded off. If, on the other hand, there is even a small spot that is not coated, there is opportunity for the parasite to obtain a foothold. With few exceptions, after the parasite has once attacked the plant, spraying is of little if any avail.

WHEN TO SPRAY.

The time of spraying will depend upon the purpose in view, but in *no case* should spraying be done when the plants are in full bloom. Spraying at this time will often interfere with the fertilization of the flowers, and consequently reduce the crop of fruit, while there is much needless destruction of bees and other insects which work upon the flowers.

In general, spray *early*. "Delays are dangerous." Fruit trees should be sprayed before the buds open, potatoes before disease or insects appear. Subsequent treatment will depend very largely upon the nature of the season; if very wet, it may be necessary to spray every two or three weeks; if relatively dry, three or four treatments may be sufficient.*

HOW TO SPRAY.

Insecticides and fungicides are more effective if applied in a liquid rather than in a dry form, since they adhere to the foliage better. *Sprinkling is not spraying.* The best results are obtained from the use of a fine spray or mist forcibly applied to the foliage; and so far as possible, it should reach the under sides of the leaves. A fine mist is preferable to a coarse spray, as there is much less waste of material and much less danger of injury to the foliage. A single dash of the mist is better than continued soaking, as in the latter case the material gathers in drops and runs off or injures the foliage.

As already stated, spraying for fungi is a preventive measure rather than a cure. If the surface of the leaf is not completely covered on both sides, with the protective coating, there is still danger of attack. The spores of the fungus may fall upon the smallest unprotected spot.

Again, while young insects may be killed by a very small dose of poison, a much larger amount will be required as they grow older. So spraying should be commenced early, that the first meal of a young insect may be his last, and in order to insure this end, the poison must be finely divided and evenly distributed.

---

* The Station has prepared specific directions for spraying; (1) Apples and other fruit trees; (2) potatoes. These will be sent free to any address upon application.

THE MATERIALS FOR SPRAYING.

The materials used in spraying are mainly of two general kinds, fungicides used in killing fungi, and insecticides, used in killing insects. The principal fungicides are Bordeaux mixture and sulphide of potassium. The more important insecticides are arsenic, in some form (usually Paris green), kerosene and tobacco.

*Bordeaux Mixture.** This is the fungicide *par excellence* for general use, and its preparation is a matter of considerable importance, The formula in general use at present is known as the "4, 4, 40" formula. In other words the mixture consists of 4 lbs. copper sulphate, 4 lbs. fresh lime and 40 gallons of water. The copper sulphate should be dissolved in three or four gallons of water in a wooden or earthen vessel and the lime (which must be absolutely fresh) should be slaked in a separate vessel, and diluted with water till it is of a milky nature. When ready for use, the two solutions may be mixed in a third vessel, care being taken to stir constantly during the process. In every case, the mixture should be passed through a sieve of number 50 brass wire cloth, or through cheese cloth backed by common window screen wire. This straining is necessary to prevent clogging of the nozzle.

Potassium Sulphide. Potassium sulphide, or "liver of sulphur" is specially valuable as a preventive of gooseberry mildew and for use in the greenhouse. In using this material four ounces of the sulphide are dissolved in ten gallons of water.

Paris Green. This material is the one which is always reliable for the destruction of leaf-eating insects. Many other forms of arsenic have been recommended, but none have proved so generally satisfactory as Paris green.† It is practically insoluble in water, but as there is usually present a small amount of soluble arsenic, it is always well to add a little fresh lime to the mixture before applying, that injury to the foliage may be averted. Paris green is generally mixed with water in the proportion of 1 pound to 200 gallons. If lime is added, however, a pound to 100 gallons may be used.

---

*More specific directions for the preparation of Bordeaux mixture will be found in the special directions for spraying, already referred to. While the use of freshly prepared Bordeaux is to be preferred, there are "prepared" Bordeaux mixtures that are used by some who doubt their ability to make the mixture. These prepared mixtures may be obtained from most dealers in spraying apparatus. The two brands which have come to the notice of the writer are the "Lenox" made by the Lenox Sprayer Company, Pittsfield, Mass., and the "Lion," made by James A. Blanchard, New York City.

† Among the cheaper substitutes for Paris green are "Green Arsenite," "Paragrene," "Emerald Green," "Arsenite of Soda," "Arsenate of Lead," etc. With the exception of the last named, which is largely used by the Gypsy Moth Commission of Massachusetts, the substitutes are still to be considered as experimental.

Kerosene. Kerosene is the specific for all sucking insects. It kills by contact and, owing to its cheapness and efficiency, will probably remain the most valuable insecticide for this class of insects. The form in which it is usually applied is the soap emulsion,* but there are now several forms of spray pumps which make a mechanical mixture of kerosene and water, thus greatly reducing the labor.

Tobacco. A strong decoction of tobacco ("tobacco tea") is often used with success in destroying the lice upon rose bushes and tender, soft-wooded plants.

WHAT APPARATUS IS NECESSARY?

In order that the best results may be obtained, suitable apparatus is needed. Such apparatus consists of a good force-pump, with one or two lines of discharge hose, nozzles, a barrel or tank for holding the mixture and a wagon for carrying all.

The Pump. The pump should be large enough to supply two lines of discharge pipe, so that one man may pump while two others distribute the spray. The small bucket and knapsack pumps do very well for a limited amount of spraying, but in field work, toys will not answer. All parts of the pump that are subject to wear should be of brass and should be carefully adjusted.

The Hose. Two pieces of one-half inch hose, of sufficient length to give freedom to the operator are needed. About fifteen feet is the length usually preferred.

The Nozzle. The nozzle is one of the most important parts of the spraying apparatus. It should throw a fine mist-like spray, and should be easily cleaned. The one in most common use is, perhaps, the Vermorel. The McGowen is one of the best for tall trees.

---

* One-half pound hard soap, 1 gallon boiling water, 2 gallons kerosene. Dissolve the soap in the water, add the kerosene and churn through a force pump for ten minutes. For use, dilute ten to twenty times with water.

The Barrel. A kerosene barrel holding about fifty gallons, or a hogshead holding 100 gallons is the best tank. It can be placed upon the side or stood on end, and a small opening made in which to place the pump and to stir the liquid.

The Wagon. Any low wagon with wide tires is suitable. For convenience in turning, a two-wheeled cart is to be preferred.

WHERE MAY APPARATUS BE OBTAINED?

Pumps and nozzles are made by many reliable firms and may be obtained at comparatively low cost by ordering directly from the manufacturers. With so many good pumps on the market, it is not easy to state which is the best.

Of the prominent manufacturers of spraying apparatus, the following is a partial list: Morrill & Morley, Benton Harbor, Mich.; The Field Force Pump Company, Lockport, N. Y.; The Goulds Mfg. Co., Seneca Falls, N. Y.; The Deming Company, Salem, O. (Chas. J. Jager & Co., No. 174 High St., Boston, New England Agents); The Lenox Sprayer Co., Pittsfield, Mass.; F. E. Myers & Bro., Ashland, Ohio; W. & B. Douglass, Middletown, Conn.; The P. C. Lewis Company, Catskill, N. Y.; William Stahl, Quincy, Ill.; The Aspinwall Mfg. Co., Jackson, Mich. All these firms are reliable and will send catalogues on application.

The manufacturers of apparatus were requested to send to the Experiment Station a list of their agents in Maine. The following names were returned: Kendall & Whitney, Portland; C. M. Conant & Co., Bangor; R. B. Dunning & Co., Bangor; A. L. & E. F. Goss Co., Lewiston; George B. Haskell & Co., Lewiston; O. F. Frost, Monmouth; J. C. Crosby, Cranberry Isle; F. A. Hussey, Topsham; G. A. Perkins, Auburn; F. L. Howe, Fairfield; L. H. Strout, Kent's Hill; G. J. Riney, Gardiner.

FERTILIZER INSPECTION.

CHAS. D. WOODS, Director.

J. M. BARTLETT, Chemist in charge of Fertilizer Analysis.

The law regulating the sale of commercial fertilizers in this State calls for two bulletins each year. The first of these contains the analyses of the samples received from the manufacturer, guaranteed to represent, within reasonable limits, the goods to be placed upon the market later. The second bulletin contains the analyses of the samples collected in the open market by a representative of the Station.

The analyses of the manufacturer's samples for this year were published early in March. The present bulletin contains the analyses of the Station samples and of such of the manufacturer's samples as were received after Bulletin 50 was issued.

The figures which are given as the percentages of valuable ingredients guaranteed by the manufacturers are the minimum percentages of the guarantee. If, for instance, the guarantee is 2 to 3 per cent of nitrogen, it is evident that the dealer cannot be held to have agreed to furnish more than 2 per cent and so this percentage is taken as actual guarantee. The figures under the head of "found" are those showing the actual composition of the samples.

A comparison of the results of the analyses of the samples collected by the Station with the percentages guaranteed by the manufacturers shows, that, while as a rule the fertilizers sold in the State are up to guarantee, in some instances the particular lots of fertilizers sampled are not as good as they should be. The comparisons indicate that many of the manufacturers do not intend to do much more than make good the minimum guarantee and it is not surprising that this results in some of the goods falling below the guarantee in one or more ingredients. As this seems to be a growing tendency, it has been thought best to make a list of the brands which fall considerably below guarantee. The table which follows gives the names of the goods and the ingredients in which they are deficient. No brand is included in this list unless it falls short by at least one-tenth in one or more of its ingredients. While the number of brands which are considerably below their guarantee in one or more ingredients is quite large, there is little reason for thinking that there is any intention to defraud. It frequently happens that a fertilizer which is below in one ingredient is considerably above in others. While this frees the manufacturer from the suspicion of attempting to defraud, it is nevertheless a serious defect in a fertilizer. It is not enough that a fertilizer contains an equivalent amount of some other kind of plant food. When the purchaser pays for fifty pounds of nitrogen he is not rightly treated if the manufacturer gives him thirty pounds of nitrogen, even though he gives him enough more of potash or phosphoric acid to make a financial equivalent.

One of the claims which fertilizer manufacturers are making for the superiority of their goods over "home mixed fertilizers" is that the former are "manufactured." This should mean, if it means anything, that the goods are more evenly mixed and therefore more uniform. In the tables it will be found that in some instances in which two samples of the same brand have been taken and analyzed, that they differ from each other quite materially. The samples were taken with a great deal of care by experienced men from a large number of packages. It would not seem difficult to make "home mixed fertilizers" which should run as uniform as some of the brands here reported upon.

The goods made by the Provincial Chemical Fertilizer Company differ so greatly in composition from the guarantee that the only conclusion seems to be that the company does not know what it is doing. This is illustrated by comparing the guarantee and the analysis of their Imperial Superphosphate as follows:

	Guaranteed. %	Found. %
Nitrogen	2.51	.86
Available phosphoric acid	9.80	9.12
Total phosphoric acid	12.10	17.00
Potash	1.50	5.01

Notwithstanding the great discrepancies between guarantee and the actual composition of the goods offered, it has not been deemed best to report the case to the Secretary of Agriculture. Correspondence seems to indicate that while the Company has made great mistakes, that there was no intention to defraud. If they sell goods in Maine next year they will take pains to learn their composition before offering them.

A LIST OF FERTILIZERS SOLD IN MAINE IN 1899, THE OFFICIALLY COLLECTED SAMPLES OF WHICH CONTAINED LESS THAN NINE-TENTHS OF THE GUARANTEED AMOUNTS OF ONE OR MORE OF THE FERTILIZING CONSTITUENTS.

Kind of Fertilizer.	Deficient in.
Blanchard's Fish, Bone and Potash	Total phosphoric acid.
Stockbridge Seeding Down Manure	Total phosphoric acid.
Stockbridge Top Dressing Manure	Nitrogen.
Bradley's Eureka Fertilizer	Available phosphoric acid.
Bradley's X. L. Phosphate	Nitrogen.
Great Planet Manure	Nitrogen.
Cleveland Bone and Potash	Potash.
Darling's Animal Fertilizer "G" Brand	Potash.
*Darling's Blood, Bone and Potash	Nitrogen and potash.
Lister's Seeding Down Fertilizer	Potash.
Swift's Lowell Ground Bone	Nitrogen.
Otis Seeding Down Fertilizer	Nitrogen and total phosphoric acid.
Philbrick's Fertilizer	Available phosphoric acid.
Provincial Chemical Fertilizer Co.'s Imperial Superphosphate	Nitrogen.
Provincial Chemical Fertilizer Co's Special Potato Phosphate	Nitrogen.
*Quinnipiac Phosphate	Nitrogen.
Maine State Grange Potato Manure	Nitrogen.
Dirigo Fertilizer	Nitrogen and total phosphoric acid.

* A second sample drawn at another place while not up to the guarantee was better than this one.

LICENSED FERTILIZERS NOT FOUND IN THE STATE.

The following brands were licensed and probably sold in the State, but were not found by the inspector. The analysis of the manufacturers' samples of these goods is here reprinted from Bulletin 50 of this Station.

DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1899.

Station number.	Manufacturer, place of business and brand.
	E. L. LEWIS, ATLANTIC, MASS.
2132	Lewis Potato Fertilizer
	RUSSIA CEMENT CO., GLOUCESTER, MASS.
1410	Essex Complete Manure for Corn, Grain and Grass
1411	Essex Complete Manure for Potatoes, Roots and Vegetables
2106	Essex Corn Fertilizer
2107	Maine State Grange Seeding Down Fertilizer
	STANDARD FERTILIZER CO., BOSTON, MASS.
1890	Standard Bone and Potash

ANALYSES OF MANUFACTURERS' SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
			Total.					Available.		Total.			
	As ammonia, or nitrates.	As organic.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2132	1.20	2.36	3.56	3.28	3.74	2.40	1.93	6.14	5.0	8.07	6.0	10.43	10.0
1410	......	......	4.00	3.70	3.02	6.39	2.51	9.41	7.0	11.92	9.5	10.52	9.5
1411	......	......	3.96	3.70	2.60	5.54	2.84	8.14	7.0	10.98	9.0	9.18	8.5
2106	.52	1.72	2.24	2.00	5.31	4.03	4.14	9.34	9.0	13.48	11.0	3.33	3.0
2107	......	1.91	1.91	1.50	3.19	4.24	6.36	7.43	7.0	13.79	13.0	5.69	5.5
1890	......	......	......	......	6.94	3.03	1.51	9.97	8.0	11.48	10.0	4.10	2.5

TRADE VALUATIONS.

In 1894 this Station stopped printing trade valuations. Although this was explained at the time, letters are occasionally received in which correspondents ask for trade valuations and our reasons for not publishing them. The reasons briefly stated are as follows:

The chief reason is that *commercial* values are not the same as *agricultural* values. Trade values are determined by market conditions, the agricultural value is measured by the increase of crop. Printing trade valuations increases the tendency, already far too strong, to purchase fertilizers on the *ton* basis without regard to the content or form of plant food. The agricultural value of a fertilizer depends upon the amount and form of nitrogen, phosphoric acid and potash it contains and the use to which it is to be put. The purchase of a fertilizer is really the purchase of one or more of these ingredients, and the thing of first importance is not the trade value of a ton, but the kinds and pounds of plant food contained in a ton.

In the selection of a fertilizer, the first question to be decided is, what use is to be made of it. Is it nitrogen, phosphoric acid or potash that is needed, or is it any two or all three that must be had? Is the fertilizer to supplement farm manures, to act as a "starter" for the crop or must it furnish all the plant food for the crop?

Having decided just what plant food is needed, it is now time to consult the fertilizer bulletin and see which of the brands there given has an analysis nearest to the required one. In this selection generally only high grade goods (those having high percentages of plant food) should be considered, as high grade goods cannot be made from inferior sources of plant food. Low grade can be made from high grade goods by the use of "fillers," but high grade goods cannot be made from other than high class materials. Freight costs no more on a ton of goods having 500 pounds of plant food than on a ton having only 200 pounds of plant food, nor is the cost of mixing a ton of high grade goods greater than the cost of mixing low grade goods.

The final step is to inquire prices and buy the kind which comes nearest to meeting the needs at the lowest price per ton. The cost, although of great importance, is to be considered *after* the kinds and amounts of plant food needed are decided upon.

That which transcends everything else in the purchase of fertilizers is to know *what* you want and then get it—get it as cheap as you can and still get the kind of plant food needed. No one would think of buying salt for sugar because it can be obtained at a lower price, but the writer has knowledge of the purchase of nitrogen when potash was needed, simply because the trade value of a nitrogenous fertilizer as printed exceeded its selling price. The fertilizer bulletin thus became misleading to the unthinking man, and largely on this account the printing of trade values was discontinued.

DESCRIPTIVE LIST OF STATION SAMPLES, 1899.

Station number.	Manufacturer, place of business, and brand.	Sampled at.
	HIRAM BLANCHARD, EASTPORT, ME.	
2154	Blanchard's Fish, Bone and Potash	Houlton
	BOWKER'S FERTILIZER CO., BOSTON, MASS.	
2155	Bowker's Bone and Wood Ash Fertilizer	Belfast
2156	Bowker's Corn Phosphate	Portland
2157	Bowker's Early Potato Manure	Caribou
2158	Bowker's Farm and Garden Phosphate	Portland
2159	Bowker's Fresh Ground Bone	Portland
2160	Bowker's High Grade Fertilizer	Bangor
2161	Bowker's Hill and Drill Phosphate	Portland
2162	Bowker's Lawn and Garden Dressing	Portland
2163	Bowker's Market Garden Manure	Bangor
2164	Bowker's Potash—Bone	Bangor
2165	Bowker's Potato and Vegetable Manure	Houlton
2166	Bowker's Potato and Vegetable Phosphate	Houlton
2167	Bowker's 6% Potato Fertilizer	Presque Isle
2168	Bowker's Special Fertilizers—Potato and Vegetables	Bangor
2169	Bowker's Square Brand Bone and Potash	Presque Isle
2170	Bowker's Staple Phosphate or 3% Fertilizer	Belfast
2171	Bowker's Superphosphate with Potash	Belfast
2172	Bowker's Sure Crop Phosphate	Portland
2173	Bowker's 10% Manure	Houlton
2174	Gloucester Fish and Potash	Belfast
2175	Stockbridge Corn and Grain Manure	Portland
2176	Stockbridge Pea and Bean Manure	Bangor
2177	Stockbridge Potato and Vegetable Manure	Houlton
2178	Stockbridge Seeding Down Manure	Bangor
2179	Stockbridge Strawberry Manure	Bangor
2180	Stockbridge Top Dressing Manure	Bangor
	BRADLEY FERTILIZER CO., BOSTON, MASS.	
2181	Bradley's Complete Manure for Potatoes and Vegetables	Houlton
2299	Bradley's Complete Manure for Potatoes and Vegetables	Portland
2182	Bradley's Corn Phosphate	Portland
2183	Bradley's English Lawn Fertilizer	Bangor
2184	Bradley's Eureka Fertilizer	Bangor
2185	Bradley's Potato Fertilizer	Portland
2186	Bradley's Potato Manure	Portland
2187	Bradley's X. L. Phosphate	Belfast
2300	Bradley's X. L. Phosphate	Portland
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.	
2188	Bay State Defiance Phosphate	Portland
2189	Bay State Fertilizer	Bangor
2190	Bay State Fertilizer for Seeding Down	Bangor
2191	Bay State Fertilizer, G. G	Bangor
2192	Great Planet Manure	Houlton
2301	Great Planet Manure	Bangor
2193	King Philip Alkaline Guano for Potatoes	Belfast
2194	Triumph Bone and Potash	Bangor

ANALYSES OF STATION SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2154	.74	1.97	2.71	2.50	......	1.86	2.02	1.86	2.00	3.88	4.50	5.33	4.50
2155	1.62	.01	1.63	1.50	......	7.16	3.83	7.16	6.00	10.99	8.00	2.45	2.00
2156	.84	.73	1.57	1.60	2.87	5.01	2.63	7.88	7.00	10.51	9.00	2.59	2.00
2157	1.90	1.26	3.16	3.00	4.67	2.71	1.86	7.38	7.00	9.24	9.00	8.16	7.00
2158	.68	.98	1.66	1.50	7.07	3.12	1.56	10.19	8.00	11.75	10.00	2.22	2.00
2159	.12	2.51	2.63	2.25	......	.....	......	......	......	22.67	18.00	......	......
2160	1.38	1.11	2.49	2.25	5.69	2.81	2.58	8.50	8.00	11.08	10.00	4.65	4.00
2161	.86	1.47	2.33	2.25	7.42	2.64	1.30	10.06	9.00	11.36	12.00	2.41	2.00
2162	3.83	......	3.83	3.00	.....	7.12	1.90	7.12	6.00	9.02	8.00	5.14	5.00
2163	.88	1.86	2.74	2.25	4.21	2.04	2.03	6.25	6.00	8.28	8.00	10.69	10.00
2164	.70	.16	.86	.75	2.76	3.11	2.58	5.87	6.00	8.45	8.00	2.26	2.00
2165	1.36	1.02	2.38	2.25	5.45	2.96	2.91	8.41	9.00	11.32	11.00	4.12	4.00
2166	.88	.71	1.59	1.50	5.74	3.51	1.86	9.25	8.00	11.11	10.00	2.35	2.00
2167	.66	.33	.99	.75	5.28	3.08	2.26	8.36	7.00	10.62	10.00	6.37	6.00
2168	1.30	1.29	2.59	2.25	4.99	3.25	2.53	8.24	8.00	10.77	10.00	4.56	4.00
2169	.08	1.99	2.07	1.50	1.53	4.45	6.05	5.98	6.00	12.03	12.00	2.41	2.00
2170	.80	.23	1.03	.75	6.24	3.38	2.03	9.62	8.00	11.65	10.00	3.15	3.00
2171	.....	.....	......	.....	.75	8.87	3.46	9 62	10.00	13.08	11.00	2.16	2.00
2172	.49	.53	1.02	.75	6.14	3.61	2.44	9.75	8.00	12.19	10.00	2.30	1.00
2173	.58	.39	.97	.75	2.58	4.18	3.15	6.76	6.00	9.91	8.00	10.46	10.00
2174	.63	.25	.88	.75	5.50	4.23	3.57	9.73	6.00	13.30	9.00	1.49	1.00
2175	1.24	1.97	3.21	3.00	6.91	2.28	.85	9.19	8.00	10.04	10.00	7.28	6.00
2176	.78	2.07	2.85	2.00	3.96	2.26	2.03	6.22	6.00	8.25	8.00	9.96	6.00
2177	1.26	2.02	3.28	3.25	4.59	2.23	2.83	6.82	6.00	9.65	7 00	11.99	10.00
2178	.66	2.08	2.74	2.50	4.48	2.27	1.79	6.75	6.00	8.54	12.00	10.60	10.00
2179	1.36	1.30	2.66	2.25	5.61	4.19	3.33	9.80	6.00	13.13	7.00	4.94	4.00
2180	3.48	.75	4.23	5.00	4.99	2.67	1.42	7.66	4.00	9.08	6.00	7.10	6.00
2181	1.09	1.89	2.98	3.30	5.63	2.72	2.23	8.35	8.00	10.58	9.00	6.81	7.00
2299	1.38	1.71	3.09	3.30	4.16	4.32	1.88	8.48	8.00	10.36	9.00	6.32	7.00
2182	.12	2.07	2.19	2.05	6.49	2.99	2.37	9.48	9.00	11.85	10.00	2.19	1.50
2183	4.92	.01	4.93	4.95	4.61	4.45	1.42	6.06	5.00	7.48	6.00	3.20	2.50
2184	.10	1.83	1.93	1.03	3.33	2.15	5.05	5.48	8.00	10.53	9.00	2.16	2.00
2185	.24	2.34	2.58	2.06	5.44	3.58	2.63	9.02	9.00	11.65	11.00	3.57	3.25
2186	.82	1.70	2.52	2.50	6.59	.15	2.92	6.74	6.00	9.66	8.00	5.87	5.00
2187	1.04	1.28	2.32	2.50	6.94	2.91	1.99	9.85	9.00	11.84	11.00	2.35	2.00
2300	.44	1.79	2.23	2.50	5.87	3.76	2.77	9.63	9.00	12.40	11.00	2.40	2.00
2188	.18	.94	1.12	.82	2.42	5.93	3.19	8.35	7.00	11.54	9.00	1.20	1.00
2189	.90	1.72	2.62	2.47	6.75	2.87	2.07	9.62	9.00	11.69	10.00	1.90	2.00
2190	.06	1.07	1.13	1.03	5.92	2.46	1.93	8.38	8.00	10.31	10.00	2.61	2.00
2191	.14	2.13	2.27	1.85	5.81	3.25	2.28	9.06	8.50	11.34	10.00	2.24	2.00
2192	1.18	1.78	2.96	3.30	5.85	1.54	3.19	7.39	8.00	10.58	9.00	7.87	7.00
2301	.74	1.93	2.67	3.30	2.22	5.43	3.09	7.65	8.00	10.74	9.00	6.39	7.00
2193	.10	1.33	1.43	1.23	4.58	3.51	3.46	8.09	6.50	11.55	8.00	3.26	3.00
2194	......	.....	... ..	.....	8.96	1.16	2.28	10.12	10.00	12.40	11.00	2.05	2.00

DESCRIPTIVE LIST OF STATION SAMPLES, 1899.

Station number.	Manufacturer, Place of Business, and Brand.	Sampled at
	CLEVELAND DRYER CO., BOSTON, MASS.	
2298	Cleveland Bone and Potash	Bangor
2195	Cleveland Fertilizer for All Crops	Portland
2196	Cleveland Pioneer Fertilizer	Bangor
2197	Cleveland Potato Phosphate	Portland
2198	Cleveland Seeding Down Fertilizer	Portland
2199	Cleveland Superphosphate	Portland
	E. FRANK COE CO., NEW YORK, N. Y.	
2200	E. Frank Coe's Bay State Phosphate	Belfast
2201	E. Frank Coe's Columbian Special Corn Fertilizer	Bangor
2202	E. Frank Coe's Columbian Special Potato Fertilizer	Portland
2203	E. Frank Coe's Excelsior Potato Fertilizer	Belfast
2204	E. Frank Coe's Grass and Grain Fertilizer	Portland
2205	E. Frank Coe's High Grade Ammoniated Bone Phosphate	Belfast
2206	E. Frank Coe's High Grade Potato Fertilizer	Belfast
2207	E. Frank Coe's New Englander Potato Fertilizer	Bangor
3208	E. Frank Coe's Prize Brand Grain and Grass Fertilizer	Portland
2209	E. Frank Coe's Special Potato Fertilizer	Bangor
2210	E. Frank Coe's Standard Grade Ammoniated Bone Phosphate	Portland
	CROCKER CHEM. & FERT. CO., BUFFALO, N. Y.	
2211	Crocker's Ammoniated Corn Phosphate	Bangor
2313	Crocker's Ammoniated Corn Phosphate	Bangor
2212	Crocker's New Rival Superphosphate	Bangor
2314	Crocker's New Rival Superphosphate	Bangor
2213	Crocker's Potato, Hop and Tobacco Phosphate	Bangor
2315	Crocker's Potato, Hop and Tobacco Phosphate	Bangor
2214	Crocker's Superior Fertilizer	Bangor
2316	Crocker's Superior Fertilizer	Bangor
2215	Crocker's Superior Rye and Oats Fertilizer	Bangor
	CUMBERLAND BONE PHOS. CO., PORTLAND, ME.	
2216	Cumberland Hawkeye Fertilizer	Bangor
2217	Cumberland Potato Fertilizer	Belfast
2218	Cumberland Seeding Down Manure	Bangor
2219	Cumberland Superphosphate	Bangor
	L. B. DARLING FERT. CO., PAWTUCKET, R. I.	
2220	Darling's Animal Anchor Brand	Augusta
2221	Darling's Animal Fertilizer "G" Brand	Augusta
2222	Darling's Blood, Bone and Potash	Houlton
2302	Darling's Blood, Bone and Potash	Augusta
	F. S. FARRAR & CO., BANGOR, ME.	
2223	Farrar's Potato Manure	Bangor
2224	Farrar's Superphosphate	Bangor
	GREAT EASTERN FERTILIZER CO., RUTLAND, VT.	
2225	Great Eastern Dissolved Bone	Portland
2226	Great Eastern Gen. Fertilizer	Portland
2227	Great Eastern Grass and Oats Fertilizer	Portland
2228	Great Eastern Northern Corn Special	Bangor
2229	Great Eastern Potato Manure	Bangor
	LISTER'S AGRICUL. CHEM. WORKS, NEWARK, N. J.	
2230	Lister's Seeding Down Fertilizer	Bangor
2231	Lister's Special Potato Fertilizer	Bangor
2232	Lister's Success Fertilizer	Bangor
2233	Lister's "U. S." Superphosphate	Bangor

ANALYSES OF STATION SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
			Total.					Available.		Total.			
	As ammonia or nitrates.	As organic.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2298	......	......	......	......	6.62	3.50	2.63	10.12	8.00	12.75	10.00	2.21	2.50
2195	.14	1.22	1.36	1.03	7.42	.75	1.70	8.17	8.00	9.87	9.00	2.10	2.00
2196	.18	1.08	1.26	.82	3.94	4.58	2.59	8.52	7.00	11.11	9.00	1.33	1.00
2197	1.02	1.24	2.26	2.05	3.24	5.29	2.39	8.53	8.00	10.92	10.00	2.86	3.00
2198	.08	2.00	2.08	1.03	5.61	4.19	1.53	9.80	8.00	11.33	9.00	2.32	2.00
2199	.20	1.94	2.14	2.05	5.26	3.56	2.79	8.82	9.00	11.61	11.00	2.51	2.00
2200	.24	1.61	1.85	2.00	6.86	2.34	2.32	9.20	9.00	11.52	11.00	3.30	1.85
2201	.20	1.30	1.50	1.23	6.86	2.99	2.68	9.85	8.50	12.53	10.50	3.03	2.50
2202	.24	1.09	1.33	1.20	5.68	3.27	2.93	8.95	8.50	11.88	10.00	*2.91	2.50
2203	.62	2.07	2.69	2.50	6.62	1.63	2.22	8.25	8.00	10.47	8.00	*8.09	8.00
2204	.20	.84	1.04	.80	6.62	3.34	1.59	9.96	8.50	11.55	10.00	2.28	1.50
2205	.18	1.96	2.14	1.85	6.86	2.61	2.19	9.47	9.00	11.66	11.00	2.66	2.25
2206	1.20	1.54	2.74	2.40	6.19	2.20	2.17	8.39	7.00	10.56	8.00	*6.35	6.50
2207	.08	.99	1.07	.80	4.75	3.65	3.29	8.40	7.00	11.69	9.00	3.38	3.00
2208	......	......	......	......	7.18	3.47	2.12	10.65	10.50	12.77	12.00	2.26	2.00
2209	.30	1.64	1.94	1.65	7.34	1.84	3.38	9.18	8.00	12.56	10.00	*4.21	4.00
2210	.22	1.27	1.49	1.20	7.03	2.88	2.42	9.91	8.50	12.33	10.00	2.45	2.25
2211	.10	2.22	2.32	2.05	6.33	3.54	1.47	9.87	10.00	11.34	11.00	1.74	1.62
2313	.04	2.12	2.16	2.05	6.62	3.05	2.17	9.67	10.00	11.84	11.00	1.76	1.62
2212	.10	1.40	1.50	1.23	5.50	4.08	2.33	9.63	10.00	11.96	11.00	1.75	1.62
2314	.04	1.36	1.40	1.23	6.94	2.08	2.64	9.02	10.00	11.66	11.00	1.73	1.62
2213	.08	2.12	2.20	2.05	5.95	3.77	1.84	9.72	10.00	11.56	11.00	3.32	3.24
2315	.42	1.80	2.22	2.05	6.65	3.01	1.63	9.66	10.00	11.29	11.00	3.26	3.24
2214	.04	1.06	1.10	.82	3.94	3.69	1.95	7.63	8.00	9.59	9.00	2.03	2.00
2316	.08	.92	1.00	.82	5.02	3.36	1.79	8.38	8.00	10.17	9.00	2.59	2.00
2215	.08	.92	1.00	.82	5.12	4.07	1.28	9.19	8.00	10.47	9.00	2.81	2.00
2216	.10	1.18	1.28	.82	5.31	3.41	1.93	8.72	7.00	10.65	9.00	1.43	1.00
2217	.87	1.19	2.06	2.06	5.95	3.05	1.16	9.00	9.00	10.16	11.00	2.90	3.00
2218	.06	1.14	1.20	1.03	5.93	2.74	1.80	8.67	8.00	10.47	10.00	2.43	2.00
2219	.89	1.17	2.06	2.06	6.01	2.88	2.12	8.89	8.00	11.01	10.00	2.63	2.00
2220	.16	2.05	2.21	1.65	7.10	2.32	.79	9.42	6.00	10.21	7.00	2.10	2.00
2221	.16	2.23	2.39	2.06	7.23	2.02	.75	9.25	6.00	10.00	7.00	3.51	4.00
2222	1.27	2.32	3.59	4.12	5.17	3.88	.68	9.05	7.00	9.73	8.00	6.72	7.50
2302	.90	2.70	3.60	4.12	5.69	2.88	.74	8.57	7.00	9.31	8.00	7.73	7.50
2223	......	......	3.60	2.25	1.50	7.80	6.91	9.30	9.00	16.21	12.00	2.76	3.00
2224	.....	......	3.46	2.50	1.44	7.86	6.93	9.30	9.00	16.23	12.00	2.70	2.00
2225	......	.....	......	......	11.16	3.60	.36	14.76	14.00	15.12	....	......	......
2226	.06	.88	.94	.82	5.92	3.41	1.54	9.33	8.00	10.87	......	5.11	4.00
2227	......	......	......	.....	7.40	4.21	2.09	11.61	11.00	13.70	......	1.80	2.00
2228	.16	2.93	3.09	2.88	.77	6.54	3.85	7.31	8.00	11.16	......	2.64	2.00
2229	.14	2.21	2.35	2.06	1.23	7.04	2.68	8.27	8.00	10.95	......	4.57	4.00
2230	.14	.80	.94	.62	7.18	3.25	2.19	10.43	10.00	12.62	11.00	1.49	1.92
2231	.22	1.51	1.73	1.65	5.18	2.74	3.00	7.92	8.00	10.92	9.00	3.51	3.00
2232	.24	1.27	1.51	1.24	6.78	2.73	2.54	9.51	9.50	12.05	11.50	2.24	2.00
2233	.20	1.29	1.49	1.32	3.16	3.86	2.74	7.02	7.00	9.76	8.00	2.77	2.00

* Largely sulphate.

DESCRIPTIVE LIST OF STATION SAMPLES, 1899.

Station number.	Manufacturer, place of business, and brand.	Sampled at.
	LOWELL FERTILIZER CO., BOSTON, MASS.	
2234	Swift's Lowell Animal Fertilizer	Bangor
2235	Swift's Lowell Bone Fertilizer	Bangor
2236	Swift's Lowell Dissolved Bone and Potash	Bangor
2237	Swift's Lowell Ground Bone	Bangor
2238	Swift's Lowell Potato Phosphate	Bangor
	NATIONAL FERTILIZER CO., BRIDGEPORT, CONN.	
2239	Chittenden's Ammoniated Bone Fertilizer	Presque Isle
2240	Chittenden's Complete Root Fertilizer	Caribou
2241	Chittenden's Market Garden Fertilizer	Fort Fairfield
	SAMUEL G. OTIS, HALLOWELL, ME.	
2242	Otis Potato Fertilizer	Hallowell
2243	Otis Seeding Down Fertilizer	So. Windham
2244	Otis Superphosphate	So. Windham
	PACIFIC GUANO CO., BOSTON, MASS.	
2245	Pacific Guano Co.'s Dissolved Bone and Potash	Bangor
2246	Pacific Guano Co.'s Grass and Grain Fertilizer	Portland
2247	Pacific Guano Co.'s Potato Special	Belfast
2248	Nobsque Guano	Bangor
2249	Soluble Pacific Guano	Bangor
2303	Soluble Pacific Guano	Portland
	PACKER'S UNION FERT. CO., NEW YORK, N. Y.	
2250	Packer's Union Animal Corn Fertilizer	Portland
2251	Packer's Union High Grade Potato Manure	Blaine
2252	Packer's Union Universal Fertilizer	Blaine
2253	Packer's Union Wheat, Oats and Potato Fertilizer	Blaine
	PARMENTER & POLSEY FER. CO., PEABODY, MASS.	
2254	"A. A." Brand	Presque Isle
2255	Plymouth Rock Brand	Presque Isle
2256	"P. and P." Potato Fertilizer	Presque Isle
2257	Parmenter & Polsey Special Potato Fertilizer	Presque Isle
2258	Star Brand Superphosphates	Presque Isle
	EDWIN J. PHILBRICK, AUGUSTA, ME.	
2259	Philbrick's Fertilizer	Augusta
	PORTLAND RENDERING CO., PORTLAND, ME.	
2260	Portland Rendering Co.'s Bone Tankage	East Deering
	PROVINCIAL CHEM. FERT. CO., L'T'D, ST. JOHN, N. B., CANADA.	
2261	Imperial Superphosphate	Presque Isle
2262	Provincial Chemical Fert. Co.'s Special Potato Phosphate	Presque Isle
	THE QUINNIPIAC CO., BOSTON, MASS.	
2263	Quinnipiac Climax Phosphate	Bangor
2264	Quinnipiac Corn Manure	Portland
2265	Quinnipiac Phosphate	Portland
2304	Quinnipiac Phosphate	Belfast
2266	Quinnipiac Potato Manure	Bangor
2305	Quinnipiac Potato Manure	Portland
2267	Quinnipiac Potato Phosphate	Bangor
2306	Quinnipiac Potato Phosphate	Portland
2268	Quinnipiac Seeding Down Manure	Portland
	READ FERTILIZER CO., NEW YORK, N. Y.	
2269	Read's Potato Manure	Bucksport
2307	Read's Potato Manure	Portland
2270	Read's Practical Potato Special	Bucksport
2271	Read's Standard Superphosphate	Bucksport
2272	Read's Sure Catch Fertilizer	Portland
2273	Read's Vegetable and Vine Fertilizer	Bucksport
2274	Sampson Fertilizer	Bucksport

ANALYSES OF STATION SAMPLES, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
	As ammonia or nitrate.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2234	.06	2.56	2.62	2.46	7.66	1.59	1.48	9.25	9.00	10.73	10.00	4.59	4.00
2235	.10	1.66	1.76	1.64	4.23	3.31	2.04	7.54	8.00	9.58	9.00	4.13	3.00
2236	.12	1.84	1.96	1.64	6.01	2.92	2.18	8.83	9.00	11.01	10.00	2.35	2.00
2237	.08	2.00	2.08	2.46	......	......	......	....	5.00	28.94	28.00	......	.....
2238	.14	2.42	2.56	2.46	5.26	2.54	1.56	7.80	8.00	9.36	9.00	*6.51	6.00
2239	.12	1.92	2.04	1.60	3.40	6.31	2.14	9.71	9.00	11.86	10.00	2.35	2.00
2240	.18	3.34	3.52	3.30	5.42	2.72	3.04	8.14	8.00	11.18	10.00	6.27	6.00
2241	.48	2.08	2.56	2.40	5.63	2.10	2.95	7.73	7.00	10.68	9.00	7.00	6.00
2242	.16	2.17	2.33	2.00	5.14	4.02	2.58	9.16	9.00	11.74	11.00	3.52	3.00
2243	.12	1.14	1.26	1.50	5.34	4.00	1.39	9.34	8.00	10.73	12.00	1.89	2.00
2244	.22	1.90	2.12	2.00	6.22	3.67	2.31	9.89	9.50	12.20	11.00	2.27	2.00
2245	....	.....	.....	......	6.14	4.93	2.65	11.07	10.00	13.72	11.00	2.07	2.00
2246	.12	1.12	1.24	.82	4.74	2.70	2.42	7.44	7.00	9.86	8.00	1.83	1.08
2247	.14	1.97	2.11	2.05	6.06	4.34	1.57	10.40	8.00	11.97	9.00	3.25	3.00
2248	.18	1.10	1.28	1.15	5.10	3.79	1.71	8.89	8.00	10.60	9.00	2.49	2.00
2249	.08	2.02	2.10	2.25	6.25	3.24	2.11	9.49	8.50	11.60	10.50	2.17	2.00
2303	.08	2.14	2.22	2.25	3.94	4.66	2.48	8.60	8.50	11.08	10.50	2.66	2.00
2250	.22	2.46	2.68	2.47	3.35	6.18	2.09	9.53	8.00	11.62	9.00	2.23	2.00
2251	.22	2.02	2.24	2.06	1.07	6.98	1.94	8.05	8.00	9.99	9.00	6.20	6.00
2252	.36	.78	1.14	.82	4.63	4.58	3.56	9.21	8.00	12.77	9.00	5.40	5.00
2253	......	......	......	......	7.10	5.56	2.79	12.66	11.00	15.45	......	2.48	2.00
2254	3.00	1.21	4.21	4.53	3.56	4.59	1.19	8.15	7.00	9.34	8.00	9.46	8.00
2255	1.38	1.29	2.67	2.47	5.12	4.82	1.62	9.94	8.00	11.56	9.00	5.02	4.00
2256	1.40	.86	2.26	1.64	2.66	4.34	1.33	7.00	6.00	8.33	7.00	7.03	5.50
2257	2.04	1.23	3.27	3.29	4.63	3.94	1.16	8.57	8.00	9.73	9.00	8.30	7.00
2258	.04	1.74	1.78	1.64	3.37	4.43	1.85	7.80	7.00	9.65	8.00	3.26	2.50
2259	1.40	.64	2.04	2.00	2.52	3.72	4.02	6.24	7.00	10.26	9.00	6.72	5.00
2260	......	......	4.54	4.42	......	6.14	10.51	6.14	......	16.65	18.59	......	......
2261	.10	.76	.86	2.51	7.18	1.94	7.88	9.12	9.80	17.00	12.10	5.01	1.50
2262	.16	.76	.92	3.08	7.00	2.50	7.22	9.50	10.11	16.72	12.28	6.43	6.02
2263	.12	1.04	1.16	1.03	4.98	3.88	1.45	8.86	8.00	10.31	9.00	2.64	2.00
2264	.12	2.09	2.21	2.06	5.42	3.86	2.48	9.28	9.00	11.76	10.00	2.39	1.50
2265	1.06	1.34	2.40	2.47	4.00	5.38	1.75	9.38	9.00	11.13	10.00	1.97	2.00
2304	.10	2.00	2.10	2.47	5.63	3.02	1.51	8.65	9.00	10.16	10.00	2.79	2.00
2266	1.70	.66	2.36	2.47	4.88	2.66	.89	7.54	6.00	8.43	7.00	4.55	5.00
2305	.70	1.57	2.27	2.47	4.45	3.97	1.34	8.42	6.00	9.76	7.00	4.65	5.00
2267	1.76	.23	1.99	2.05	2.03	6.61	2.51	8.64	8.00	11.18	9.00	3.02	3.00
2306	.54	1.69	2.23	2.05	3.01	5.51	2.64	8.52	8.00	11.16	9.00	3.00	3.00
2268	.12	1.12	1.24	.82	4.42	5.29	1.61	9.71	9.00	11.32	10.00	2.39	2.00
2269	.12	2.20	2.32	2.47	4.53	3.46	2.68	7.99	7.00	10.67	8.00	10.75	10.00
2307	.94	1.42	2.36	2.47	6.59	2.24	.79	8.83	7.00	9.62	8.00	*10.00	10.00
2270	.04	.99	1.03	.82	2.11	2.31	1.26	4.42	4.00	5.68	5.00	9.13	8.00
2271	.10	1.00	1.10	.82	5.09	3.00	1.16	8.09	8.00	9.25	9.00	4.40	4.00
2272	......	......	.....	......	1.79	4.33	.91	6.12	6.00	7.03	7.00	3.67	4.00
2273	.04	1.71	1.75	1.65	4.43	2.46	.93	6.89	6.00	7.82	7.00	8.96	8.00
2274	.10	1.68	1.78	1.65	4.31	2.31	.91	6.62	6.00	7.53	7.00	4.52	4.00

* Largely sulphate.

DESCRIPTIVE LIST OF STATION SAMPLES, 1899.

Station number.	Manufacturer, Place of Business, and Brand.	Sampled at
	RUSSIA CEMENT CO., GLOUCESTER, MASS.	
2275	Essex Potato Fertilizer	Presque Isle
2276	Essex XXX Fish and Potash	Presque Isle
2277	Maine State Grange Chemicals	Houlton
2278	Maine State Grange Potato Manure	Houlton
	SAGADAHOC FERT. CO., BOWDOINHAM, ME.	
2279	Dirigo Fertilizer	Cumberland
2280	Merrymeeting Superphosphate	Brewer
2281	Sagadahoc Bone Meal	Bowdoinham
2282	Sagadahoc Special Potato Fertilizer	Brewer
2308	Sagadahoc Special Potato Fertilizer	Cumberland
2283	Sagadahoc Superphosphate	Cumberland
2284	Yankee Fertilizer	Brewer
	STANDARD FERTILIZER CO., BOSTON, MASS.	
2285	Standard A Brand	Portland
2297	Standard Bone and Potash	Garland
2286	Standard Fertilizer	Bangor
2287	Standard Guano	Portland
2288	Standard Special for Potatoes	Bangor
2309	Standard Special for Potatoes	Portland
	HENRY F. TUCKER CO., BOSTON, MASS.	
2289	Tucker's Original Bay State Bone Superphosphate	Portland
	JOHN WATSON, HOULTON, ME.	
2136	Watson's Potato Manure	Houlton
	WILLIAMS & CLARK FERT. CO., BOSTON, MASS.	
2290	Americus Ammoniated Bone Superphosphate	Portland
2291	Americus Corn Phosphate	Portland
2310	Americus Corn Phosphate	Bangor
2292	Americus Potato Manure	Bangor
2311	Americus Potato Manure	Portland
2293	Prolific Crop Producer	Belfast
2294	Royal Bone Phosphate for All Crops	Bangor
2295	Williams & Clark's Potato Phosphate	Portland
	A. F. YOUNG AND CO., NEW YORK, N. Y.	
2296	Young's Excelsior Potato Fertilizer	Presque Isle

Analyses of Station Samples, 1899.

Station number.	NITROGEN.				PHOSPHORIC ACID.							POTASH.	
	As ammonia or nitrates.	As organic.	Total.		Soluble.	Reverted.	Insoluble.	Available.		Total.		Found.	Guaranteed.
			Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.		
	%	%	%	%	%	%	%	%	%	%	%	%	%
2275	.98	1.02	2.00	2.00	3.83	7.53	3.85	11.36	9.00	15.21	11.00	6.29	5.00
2276	.08	2.46	2.54	2.10	4.59	6.07	5.10	10.66	9.00	15.76	12.00	2.46	2.25
2277	1.64	.89	2.53	2.50	4.86	3.83	4.39	8.69	8.00	13.08	12.00	4.31	4.00
2278	.70	.32	1.02	1.50	3.51	7.33	2.49	10.84	9.00	13.33	12.00	12.47	12.00
2279	.08	1.38	1.46	2.00	1.99	3.30	2.76	5.29	3.00	8.05	10.00	5.53	4.00
2280	.30	1.34	1.64	1.50	3.11	2.95	2.23	6.06	5.00	8.29	9.00	3.14	2.00
2281	.18	4.33	4.51	3.00	......	......	......	.....	.....	18.09	20.00	......	......
2282	1.56	.60	2.16	2.40	5.26	3.43	1.03	8.69	6.00	9.72	10.00	*8.67	7.00
2308	1.48	.90	2.38	2.40	5.49	3.01	.84	8.50	6.00	9.34	10.00	*8.65	7.00
2283	1.36	.67	2.03	2.10	5.58	3.28	1.35	8.86	6.00	10.21	10.00	6.12	4.00
2284	.14	.92	1.06	.50	2.36	3.75	1.25	6.11	3.00	7.36	7.00	4.39	1.50
2285	.14	1.06	1.20	.82	3.38	5.22	2.67	8.60	7.00	11.27	9.00	1.18	1.00
2297	......	.....	......	.....	6.08	4.17	1.77	10.25	8.00	12.02	10.00	2.39	2.50
2286	.76	1.45	2.21	2.00	6.09	4.00	1.84	10.09	8.00	11.93	10.00	2.22	2.00
2287	.82	.70	1.52	1.25	7.23	2.33	2.58	9.56	6.50	12.14	8.50	3.28	3.00
2288	1.02	.94	1.96	2.05	2.47	5.76	2.51	8.23	8.00	10.74	9.00	3.20	3.00
2309	.56	1.74	2.30	2.05	2.55	6.02	2.63	8.57	8.00	11.20	9.00	2.83	3.00
2289	.12	2.13	2.25	2.06	5.53	3.95	1.56	9.48	9.00	11.04	11.00	2.24	2.00
2136	.16	2.39	2.55	2.50	2.49	3.56	.84	6.05	6.00	6.89	7.00	5.00	5.00
2290	.92	1.42	2.34	2.47	6.27	4.02	2.16	10.29	9.00	12.45	10.00	2.36	2.00
2291	.12	2.23	2.35	2.06	5.15	3.74	2.70	8.89	9.00	11.59	10.00	2.29	1.50
2310	.10	2.13	2.23	2.06	5.01	3.83	3.00	8.84	9.00	11.84	10 00	1.98	1.50
2292	1.02	.99	2.01	2.06	2.55	6.11	2.50	8.66	8.00	11.16	9.00	2.84	3.00
2311	.38	1.78	2.16	2.06	2.44	6.78	2.19	9.22	8.00	11.41	9.00	2.99	3.00
2293	.10	1.12	1.22	.82	6.27	3.15	2.03	9.42	6.00	11.45	7.00	1.51	1.00
2294	.14	1.02	1.16	1.03	5.10	4.10	1.49	9.20	7.00	10.69	8.00	2.30	2.00
2295	1.00	1.48	2.48	2.47	3.54	4.09	1.63	7.63	6.00	9.26	7.00	5.14	5.00
2296	1.86	.88	2.74	2.88	3.68	2.81	.60	6.49	5.50	7.09	......	10.33	10.00

* Largely sulphate.

DESCRIPTIVE LIST OF MANUFACTURERS' SAMPLES, 1899.*

Station No.	Manufacturer, place of business, and brand.
	BOWKER FERTILIZER CO., BOSTON, ASS.
2145	Bowker's Early Potato Manure
2146	Bowker's Lawn and Garden Dressing
2147	Bowker's Potash—Bone
2148	Bowker's Potato and Vegetable Manure
	BRADLEY FERTILIZER CO., BOSTON, MASS.
2137	Bradley's English Lawn Fertilizer
	CLARK'S COVE FERTILIZER CO., BOSTON, MASS.
2138	Great Planet Manure
2139	Triumph Bone and Potash
	CLEVELAND DRYER CO., BOSTON, MASS.
2140	Cleveland Bone and Potash
	E. FRANK COE CO., NEW YORK, N. Y.
2141	E. Frank Coe's New Englander Potato Fertilizer
	PARMENTER & POLSEY FERTILIZER CO., PEABODY, MASS.
2142	"A. A." Brand
	PROVINCIAL CHEMICAL FERTILIZER CO., L'T'D, ST. JOHN, N. B.
2135	Imperial Superphosphate
2134	Special Potato Phosphate
	READ FERTILIZER CO., SYRACUSE, N. Y.
2143	Read's Potato Manure
	WILLIAMS & CLARK FERTILIZER CO., BOSTON, MASS.
2144	Prolific Crop Producer

ANALYSES OF MANUFACTURERS' SAMPLES, 1899.*

Station number.	Nitrogen.				Phosphoric Acid.							Potash.	
			Total.					Available.		Total.			
	As ammonia or nitrates.	As organic.	Found.	Guaranteed.	Soluble.	Reverted.	Insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%	%	%	%	%	%	%	%	%	%
2145	1.06	1.94	3.00	3.00	5.14	2.67	1.99	7.81	7.00	9.80	9.00	7.72	7.00
2146	3.64	-.17	3.81	3.00	5.02	1.84	1.89	6.86	6.00	8.75	8.00	5.81	5.00
2147	.87	......	.87	.75	1.83	5.41	2.65	7.24	6.00	9.89	8.00	2.36	2.00
2148	.90	1.35	2.25	2.25	5.69	4.25	1.42	9.94	9.00	11.36	11.00	4.36	4.00
2137	5.60	.....	5.60	4.95	4.83	3.36	.70	8.19	5.00	8.89	6.00	3.63	2.50
2138	1.34	1.96	3.30	3.30	6.65	2.75	.79	9.40	8.00	10.19	9.00	7.03	7.00
2139	......	......	.....	.....	7.77	3.60	.97	11.37	10.00	12.34	11.00	2.98	2.00
2140	......	......		......	8.12	4.26	1.16	12.38	8.00	13.54	10.00	3.23	2.50
2141	.20	.95	1.15	.80	7.77	2.98	1.96	10.75	7.00	12.71	9.00	*3.46	3.00
2142	3.38	.81	4.19	4.53	3.38	4.41	.83	7.79	7.00	8.62	8.00	10.69	8.00
2135	....	......	.68	2.51	7.59	1.57	7.84	9.16	9.87	17.00	12.10	4.91	1.50
2134	......	.....	.81	3.08	7.81	1.31	7.85	9.13	10.11	16.98	12.28	5.15	6.02
2143	.08	2.71	2.79	2.47	5.66	2.28	1.21	7.94	7.00	9.15	8.00	9.08	10.00
2144	.10	.97	1.07	.82	5.20	3.23	1.38	8.43	6.00	9.81	7.00	1.49	1.00

*These goods were licensed after the March Bulletin was issued.

NUTS AS FOOD.

CHAS. D. WOODS and L. H. MERRILL.

While the use of nuts in this country has already attained considerable proportions, it is believed that a careful study of their food qualities would lead to their largely increased consumption. In view of their high nutritive value and the readiness and cheapness with which they may be produced, it is a matter of some astonishment that they have received so little consideration as a food and that so little attention has been devoted to their culture. This neglect is explained in part by the abundance and cheapness of cereal products, which supply our wants so fully that we have not been forced to seek foods from unusual and less reliable sources. Although, within certain limits, grain production varies from year to year, we have few more certain crops. On the other hand, the production of nuts, like that of the apple and tree fruits in general, is subject to greater fluctuations which are far less under the immediate control of man.

It is impossible to estimate with any degree of accuracy the amount of nuts consumed in this country. The following table, furnished by the statistician of the U. S. Department of Agriculture, shows only our imports. The consumption of home grown nuts must exceed these figures many fold.

IMPORTS OF NUTS INTO THE UNITED STATES.

	TWELVE MONTHS ENDING JUNE					
	1897.		1898.		1899.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Almonds	9,644,338	$880,263	5,746,362	$659,659	9,957,427	$1,222,587
Cocoanuts	....	471,387	....	575,935	....	625,789
All other nuts	....	848,511	....	1,002,344	....	879,166

The vast range of climatic conditions to be found in this country will enable us to grow nearly all the nuts which we now import. Some progress has already been made along these lines. Our native nuts should be improved. Nuts are subject to as many and great varietal changes as apples and are doubtless as susceptible of improvement.

THE CHEMICAL COMPOSITION OF NUTS.

It is believed that with the larger supply, the improved quality and the lower prices that would in time follow an increased demand, our American dietaries would make an important gain at a small cost. It is with a view of calling more general attention to this subject that the analyses given on the following pages are presented. Those analyses to which the fuel value is added were made at this Station. The others were compiled from various sources, as indicated in the foot-notes.

Almond. (*Amygdalus communis*).

Of the almonds consumed in the United States, by far the larger part is supplied by France, Italy and Spain. Repeated attempts have been made to grow the almond in this country, but nearly all have resulted in failure. California, however, seems to offer a promising field for this culture, and the crop of that state for 1891 was estimated at 1,000,000 pounds. As the imports for the same year amounted to about 7½ million pounds, valued at nearly $1,000,000 it may be safely predicted that our production will be largely increased.

Below is given the average of the analyses of eleven varieties of California almonds, and also four analyses of European almonds.

COMPOSITION OF THE ALMOND.

	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.
Edible portion:						
California almonds *a*..........	....	4.8	21.0	54.9	17.3	2.0
European almonds *b*	....	6.0	23.5	53.0	14.4	3.1
As purchased:						
California almonds...........	*c*64.8	1.7	7.3	19.3	6.2	.7

---

a. California Experiment Station Report, 1895-96; 1896-97, p. 151.

b. Koenig: Nahrungs-und Genusmittel, I, p. 608.

c. As the proportion of shell to kernel for the dry nut was not given, we have used here the proportion found in nuts purchased in the Maine market.

Brazil Nut. (*Bertholletia excelsa*).

As its name indicates, this nut is a native of Brazil, whence large quantities are exported. In 1897 our imports were valued at $234,972. The nut has not been successfully grown in the United States.

COMPOSITION OF THE BRAZIL NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fats.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6167	....	5.3	17.0	66.8	7.0	3.9	3,329
As purchased	6167	49.6	2.7	8.6	33.6	3.5	2.0	1,678

Filbert. (*Corylus*).

The European hazels or filberts which supply our markets are crosses and varieties of two species, *C. avellana* and *C. tubulosa.* The filbert is only sparingly grown in the United States. Our native hazels are smaller than the European nuts, though some varieties have been noted which are well worthy of cultivation.

The filbert finds its chief use as a dessert nut. In some European countries where it is produced in large quantities it is ground to a flour and used for bread. Along the Black Sea shore of Asiatic Turkey the culture of the filbert has attained great importance, the production about Trebizond in 1896 being estimated at 38,518,771 pounds.

COMPOSITION OF THE FILBERT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6170	....	3.7	15.6	65.3	13.0	2.4	3,432
As purchased	6170	52.1	1.8	7.5	31.3	6.2	1.1	1,644
Edible portion [a]	......	....	7.1	17.4	62.6	10.4	2.5	

---

[a] Koenig: Nahr. u. Genussmittel, II, p. 500. The average of two analyses.

Hickory-nut.

The hickory-nut best known to our market is the fruit of the shag-bark hickory, *Hicoria ovata* Britton. Like the other hickories, it is a native of America. It has a wide range, being found from southern Maine, west to Minnesota, and south to Texas and Florida. It is said to reach its best development west of the Alleghanies.

The quality of the nut is exceedingly variable, both as to the flavor of the kernel and the readiness with which the shell can be removed. The better varieties are highly esteemed and by many are considered the best of our American nuts, for delicacy of flavor comparing not unfavorably with the English walnut. The price is as variable as the quality, ranging, at the place and time of harvest, from 20 cents to $3.00 per bushel.

COMPOSITION OF THE HICKORY-NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6171	....	3.7	15.4	67.4	11.4	2.1	3,495
As purchased	6171	62.2	1.4	5.8	25.5	4.3	.8	1,321

Pecan. (*Hicoria pecan*).

The pecan is also a native of America, but is far less widely distributed than the species last described (*Hicoria ovata*), being found from Indiana to Iowa on the north to Tennessee and Texas on the south. It thrives best in the rich, moist soils along the river banks. Although some of the largest and best pecans are grown in Louisiana, a large proportion of those placed upon the market are from Texas, where its culture has attained considerable importance.

The flavor of the pecan makes it a desirable nut, but it owes much of its popularity to the thinness of its shell and the consequent ease with which it may be removed. These qualities adapt it especially to dessert purposes. Large quantities of this nut are used by confectioners, the shelled meats in halves selling at 30 to 40 cents per pound.

COMPOSITION OF THE PECAN.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Pecans, polished:								
Edible portion	6174	....	3.0	11.0	71.2	13.3	1.5	3,633
As purchased	6174	53.2	1.4	5.2	33.3	6.2	.7	1,700
Pecans, unpolished:								
Edible portion	6173	....	2.7	9.6	70.5	15.3	1.9	3,566
As purchased	6173	46.3	1.5	5.1	37.9	8.2	1.0	1,915

English Walnut. (Juglans regia).

In the United States the walnut has been successfully cultivated in the Central and Southern Atlantic States, in California, and Oregon. In California the culture is especially successful, the product for 1898 being estimated at eight million pounds.

COMPOSITION OF THE WALNUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, det.
California soft shell, J. regia, 4 analyses *a*.								
Edible portion	......	.....	2.5	16.6	63.4	16.1	1.4	
As purchased	.....	58.1	1.0	7.0	26.6	6.7	.6	
California bijou, J. regia *a*.								
Edible portion	......	......	2.5	18.4	64.4	13.0	1.7	
As purchased	.....	73.1	.7	4.9	17.3	3.5	.5	
Italian, J. regia.								
Edible portion	6212	......	4.0	16.9	68.0	9.0	2.1	3,538
As purchased	6212	57.8	1.7	7.1	28.7	3.8	.9	1,493
Juglans regia, 4 analyses *b*.								
Edible portion	......	......	7.2	15.8	57.4	17.6	2.0	
California native black, J. California *a*.								
Edible portion	.....	......	2.5	24.9	54.7	16.1	1.8	
As purchased	......	74.1	.6	6.4	14.2	4.2	.5	
California grown American black, J. nigra *a*.								
Edible portion	......	.....	2.5	30.3	57.8	7.4	2.0	

---

a. Calif. Expt. Station, Bulletin 113, p. 12.

b. Koenig. Nahr. u. Genusmittel, II, p. 500.

Although Asiatic in its origin, this is commonly spoken of as the English walnut. Owing to its general excellence it early won its way to popular favor, having been distributed through nearly all Europe, reaching England as early as the middle of the sixteenth century.

Chestnut. (*Castanea dentata*).

The American chestnut has a wide geographical range, being found in nearly every state east of the Mississippi, from southern Maine to the Gulf. It seems to thrive best on high lands, with light and even sandy soils. Both the European and Japanese chestnuts are also cultivated here to some extent; neither of them yield nuts of as good quality as our native stock, though both excel our nut in size.* The price of the native nut varies from $1 to $10 per bushel, according to locality, abundance and excellence of the nut.

In France, where the chestnut is widely grown, the nut has come to play an important part in the dietaries of the poor. The common way of preparing the nuts is to remove the shells and steam them, when they may be eaten either with salt or milk, furnishing a cheap and nutritious food. Thus prepared, the hot nuts are sold in the streets, and form the chief morning dish for a large proportion of the working classes. Large quantities of the nuts are also dried and ground to a flour, which can be kept for some time without deteriorating. This flour, mixed with water and baked in thin sheets, forms a heavy, but sweet and nutritious cake. The use of the chestnut is not confined to the poor, since it is used in many forms by the well-to-do classes who prepare from them many palatable side dishes.

In Italy the use of the chestnut is also very general. The nut is eaten fresh, boiled and roasted, or as a substitute for corn meal in the "polenta," a form of porridge much used by the poorer classes. A common delicacy in the Apennines is "necci," flat cakes of chestnut flour and water, baked between hot, flat stones, with chestnut leaves between the cakes.† In Korea the chestnut is said almost to take the place which the potato occupies with us, being used raw, boiled, roasted, cooked with meat, or dried whole.

---

* Nut culture in the United States, U. S. Department of Agriculture, p. 82.

† Knight: Food and Its Functions, p. 199.

The chestnut differs widely from the other common nuts, since it contains much less oil and protein and much more of the carbohydrates, especially starch, which is almost wholly wanting in many nuts. It is thus a far less concentrated and better balanced food than our other nuts. The high prices which prevail in our Maine markets will prevent its very general adoption. A large and steady demand would in time lead to an increased production and ultimately to lower prices.

COMPOSITION OF THE CHESTNUT.

Variety and condition.	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.
Edible portion:							
Numbo, fresh *a*	......	......	42.2	6.1	6.6	43.3	1.8
Moon's Seedling, fresh *a*	......	....	41.7	6.3	6.4	43.8	1.8
Solebury, fresh *a*	......	....	29.2	6.7	8.3	54.0	1.8
Native, fresh *a*	......	....	34.4	8.0	10.8	45.1	1.7
Italian, fresh *b*	......	....	53.8	6.6	2.0	36.9	.7
Italian, fresh *b*	......	....	52.7	4.1	2.0	40.4	.8
Variety unknown, fresh *c*	......	....	44.9	7.3	8.0	38.3	1.5
Average, fresh nuts	......	....	42.7	6.5	6.3	43.1	1.4
Spanish, dry *a*	.....	....	6.6	9.0	6.6	75.0	2.8
Paragon, dry *a*	......	....	6.5	11.4	9.1	70.1	2.9
Spanish, dry *a*	.....	....	5.4	10.3	9.1	72.5	2.7
Native, dry *a*	.....	....	4.8	11.6	15.3	65.7	2.6
Average, dry nuts	......	....	5.8	10.6	10.0	70.8	2.8
As purchased:							
Numbo, fresh *a*	......	11.5	37.3	5.4	5.9	38.3	1.6
Moon's Seedling, fresh *a*	.....	14.3	35.7	5.4	5.5	37.5	1.6
Solebury, fresh *a*	......	15.3	24.8	5.7	7.0	45.7	1.5
Native, fresh *a*	......	23.2	26.4	6.2	8.3	34.6	1.3
Italian, fresh *b*	......	15.4	45.5	5.6	1.7	31.2	.6
Italian, fresh *b*	.....	15.5	44.5	3.5	1.7	34.1	.7
Average, fresh nuts	......	15.9	35.7	5.3	5.0	36.9	1.2
Spanish, dry *a*	......	21.5	5.2	7.0	5.2	58.9	2.2
Paragon, dry *a*	......	23.9	5.0	8.7	6.9	53.3	2.2
Spanish, dry *a*	......	25.3	4.0	7.7	6.8	54.2	2.0
Native, dry *a*	......	22.9	3.7	8.9	11.8	50.7	2.0
Average, dry nuts	......	23.4	4.5	8.1	7.7	54.2	2.1

a Penn. Expt. Station, Bulletin 16, p. 15.
b Calif. Expt. Station, Report 1895-6; 1896-7, p. 153, Bulletin 113, p. 7.
c Mass. State Expt. Station, Report, 1893, p. 354.

Peanut. (*Arachis hypogæa*).

The peanut, although not a nut in the botanical sense, is for convenience here included. It is extensively grown in at least four continents—Asia, Africa, North and South America—and has been so long and so widely cultivated that some doubt exists with regard to its origin. It is now generally regarded as a native of Brazil, although even in that country it is unknown in its wild form. Prior to 1865 the United States imported large quantities of peanuts from Western Africa. Since that date the home production has enormously increased until at the present time our crop is estimated at 4,000,000 bushels, about one-seventh of the crop of the world. Of this amount Virginia, North Carolina and Tennessee produce by far the larger part. The culture is not as profitable as formerly, since, through injudicious methods of cultivation, the previous yield of 50 or more bushels per acre has fallen to less than one-half that amount, while the cost of cultivation remains practically the same.*

There is but little waste in peanut production. The dried vines are used as hay, while the pods and low grades of the nuts are also fed to stock. Probably three-fourths of the peanuts themselves are retailed in the roasted form. A part of the cheaper grades is used by confectioners. In Europe, and to a much more limited extent in this country, the oil is extracted. This oil, forming from one-third to one-half of the kernel, is clear, sweet and palatable, for many purposes fully equal to the more costly olive oil. Indeed, much that is sold as olive oil is either peanut oil, or contains a large admixture of the same. The high grades are used in Germany as a salad oil; while the lower grades find ready use as lubricants or are employed in soap making. Although the American peanut is larger and more palatable than the African, the latter furnishes a better oil.

As a food for man, the peanut has a high claim upon the popular favor. There seems to be no reason why it should not be considered as a regular article of diet and be placed in some form upon our tables. If the cake remaining after the extraction of peanut oil be ground to a fine powder, it furnishes a flour from which a nutritious bread can be made. Attempts made in Germany to utilize this flour in the preparation of army bread have not been altogether successful, but the matter is worthy of farther trial.

---

* Farmers Bulletin, No. 25.

COMPOSITION OF THE PEANUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Total value per pound, determined.
Edible portion:								
Georgia peanut *a*	.....	.....	12.9	26.6	37.6	21.0	1.9	
Spanish peanut *a*	.....	.....	13.2	27.9	35.8	20.7	2.4	
Variety unknown *b*	.....	.....	4.9	29.1	48.8	15.3	1.9	
Variety unknown	6213	.....	6.0	28.1	45.7	17.8	2.4	3,008
Varieties unknown, 8 anal. *c*	.....	.....	6.9	27.7	45.8	17.0	2.6	
Average, 12 analyses	.....	.....	7.7	27.8	44.5	17.6	2.4	
Roasted peanut	6214	.....	1.6	30.5	49.2	16.2	2.5	3,177
As purchased:								
Georgia peanut *a*	.....	27.0	9.4	19.4	27.5	15.3	1.4	
Spanish peanut	...	22.0	10.3	21.8	27.9	16.1	1.9	
Variety unknown *b*	.....	28.8	3.5	20.7	34.7	10.9	1.4	
Variety unknown	6213	28.0	4.3	20.3	32.9	12.8	1.7	2,166
Average 4 analyses	.....	26.4	6.9	20.6	30.7	13.8	1.6	
Roasted peanuts	6214	32.6	1.1	20.6	33.1	10.9	1.7	2,141
Peanut butter *d*	.....	.....	2.1	28.7	46.4	18.8	*f* 4.0	
Peanut butter *e*	.....	.....	2.0	29.9	46.7	15.4	*g* 6.0	

a. Georgia Expt. Station, Bulletin 13, p. 64.
b. North Carolina Expt. Station, Bulletin 90 B, p. 10.
c. Koenig: Nahr. u. Genusmittel, II, p. 500.
d. From the Atlantic Peanut Refinery, Philadelphia.
e. From the Peanolina Company, New Haven.
f. Including salt 3.2 per cent.
g. Including salt 5.0 per cent.

Acorns. (*Quercus*).

The only analysis here given is of the fruit of the common black oak of the desert regions of Arizona (Q. *Emoryi*). The acorns of this species are generally known as "biotes." With this analysis is given that of a sample of acorn meal and a bread prepared from the same. Acorns in the natural state are unfit for human food on account of the large amount of tannin which they contain. The meal and bread here reported were prepared by the Indians of California who by some means succeed in removing the tannin. While the meal was found to contain 6.63 per cent tannin, only a trace was discoverable in the bread. Both meal and bread were sour and sodden when received.

The Indians of the Yosemite Valley make a porridge by stirring up acorn meal with water. This is cooked by dropping in heated stones. The cooked porridge thickens on cooling, when it is sliced and browned before the fire.

COMPOSITION OF ACORNS (QUERCUS EMORYI), ACORN MEAL, AND ACORN BREAD.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Food value per pound, determined.
Acorn, edible portion	6193	....	4.1	8.1	37.4	48.0	2.4	2,718
Acorn as received ...	6193	35.6	2.6	5.2	24.1	30.9	1.6	1,750
Acorn meal..........	6184	....	8.7	5.7	18.6	65.0	2.0	2,265
Acorn bread	6185	....	60.3	2.2	9.9	27.0	.6	2,347

Beechnut. (*Fagus Americana*).

The beech is a common forest tree over the eastern half of the United States. The nuts are sweet and among the best of our wild nuts. They are widely gathered by children; but owing to the fact that the tree is an irregular bearer, the nuts small and prime favorites with the squirrels, only a very limited amount of this nut reaches the market. The prices are as variable as the supply, ranging from 10 to 60 cents per quart.

COMPOSITION OF THE BEECHNUTS.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Fagus Americana:								
Edible portion......	6166	....	4.0	21.9	57.4	13.2	3.5	3,263
As purchased.......	6166	40.8	2.3	13.0	34.0	7.8	2.1	1,932
Fagus sylvestris *a*....								
Edible portion......	....	....	9.1	21.7	42.4	22.9	3.9	
As purchased	....	33.0	6.1	14.5	28.4	15.4	2.6	

---

a. Koenig: Nahr. u. Genusmittel, II, p. 500.

Butternut, Oil-nut, White Walnut. (*Juglans cinerea*).

The butternut is found over a large part of the eastern, middle and northern states, though it is most abundant and reaches its highest development in the Ohio River basin. Usually it is not a forest tree, but occurs most frequently in isolated positions and along fences. It is very prolific, single trees sometimes yielding 15 or 20 bushels.

Although a common nut in this State, it is not often found in the Maine markets. In the West it is more frequently met, the price ranging from 20 cents to $2 per bushel. When green the nuts are sometimes used for pickling. The thick dense shell of the ripened nut, its extreme oiliness with a tendency to become rancid, make this one of the least desirable of our nuts.

COMPOSITION OF THE BUTTERNUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6168	....	4.5	27.9	61.2	3.4	3.0	3,371
As purchased.........	6168	86.4	.6	3.8	8.3	.5	.4	458

Cocoanut. (*Cocos nucifera*).

Although large quantities of these nuts are annually imported into the United States, the home product is now considerable. During the past 20 years large numbers of trees have been planted in southern Florida, where it is estimated that there are at least 250,000 trees, over ten per cent of which are in bearing. The products of the cocoanut palm are so many and varied and find such ready application, that it may be long before our home production will satisfy the growing demand.

"The small, green and immature nuts are grated fine for medicinal use, and when mixed with the oil of the ripe nut it becomes a healing ointment. The jelly which lines the shell of the more mature nut, furnishes a delicate and nutritious food. The milk in its center, when iced, is a most delicious luxury. Grated cocoanut forms a part of the world renowned East India condiment, curry. Dried, shredded (desiccated) cocoanut is an important article of commerce.

"From the oil a butter is made, of a clear, whitish color, so rich in fat, that of water and foreign substances combined there are but .0068. It is better adapted for cooking than for table use. At present it is chiefly used in hospitals, but it is rapidly finding its way to the tables of the poor, particularly as a substitute for oleomargarine." *

COMPOSITION OF THE COCOANUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6169	....	14.1	5.7	50.6	27.9	1.7	2,986
As purchased................	6169	*a*48.8	7.2	2.9	25.9	14.3	.9	1,529
Without milk, as purchased ..	6169	*b*37.3	8.9	3.6	31.7	17.5	1.0	1,872
Cocoanut milk, as purchased .	....	......	92.7	.4	1.5	4.6	.8	97
Shredded cocoanut *c*	....	....	4.3	6.5	63.7	24.1	1.4	
Shredded cocoanut *d*..	....	....	2.8	6.0	51.0	39.0	1.2	
Edible portion *e*	....	....	5.8	8.9	67.0	16.5	1.8	
Cocoanut milk *f*.............	....	....	91.5	.5	.1	6.8	1.2	

a Milk and shell. *b* Shell only. *c* Storrs Expt. Station. *d* New Jersey Expt Station. *e* Koenig, Nahr. u. Genussmittel, II, 500. *f* Ibid, I, 495.

The meat of the cocoanut is poor in protein, as compared with most of the nuts here reported, and the milk contains about one-tenth the protein and less than one-half the fat found in the milk of the cow.

The Litchi, Leechee, or Chinese Nut. (*Nephelium litchi*).

This fruit is a native of China. It is not a true nut, although commercially classed as such. The imports to this country are quite small, and the consumption for the most part confined to the Chinese population. As the analysis indicates, it differs widely from true nuts, being very low in protein and fats and correspondingly high in carbohydrates. It finds its way to our markets only in the dried form. When fresh it is said to be one of the finest of Chinese fruits, having a white flesh with the taste of the best grapes.†

---

* Nut Culture in the United States, p. 98–99.

†Popular Science Monthly, XXVIII, p. 574.

COMPOSITION OF THE LITCHI NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6172	....	17.9	2.9	.2	77.5	1.5	1,453
As purchased.........	6172	41.6	10.5	1.7	.1	45.2	.9	849

Pine Nuts. (*Pinus*).

The seeds of three species of pine have been analyzed, *Pinus edulis* Engel., *P. monophylla* Torr. and Frem., and *P. Sabiniana* Doug.

COMPOSITION OF PINE NUTS.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Pignolias, edible portion *a*..........	......	......	6.4	33.9	49.4	6.9	3.4	
Pinon, (P. monophylla):								
Edible portion........................	6211	......	3.8	6.5	60.7	26.2	2.8	3,327
As purchased........................	6211	41.7	2.2	3.8	35.4	15.3	1.6	1,940
Pinon, (Pinus edulis):								
Edible portion	6177	......	3.4	14.6	61.9	17.3	2.8	3,364
As purchased........................	6177	40.6	2.0	8.7	36.8	10.2	1.7	1,988
Pinon, (P. sabiniana):								
Edible portion	6192	.....	5.1	28.1	53.7	8.4	4.7	3,161
As purchased.	6192	77.0	1.2	6.5	12.3	1.9	1.1	727

"The several species of pine yielding edible nuts are found on the Pacific Slope of the United States and in Colorado, New Mexico, Arizona and Mexico. The nuts are but little known to a majority of the people of the United States, though they are marketed in large quantities in some of the cities of California.

---

a From Bulletin 28 of the office of Experiment Station.

Some of them are of good size for dessert or confectionery purposes, and in quality and flavor are so superior that their general introduction will doubtless make them very popular.—Along the borders of Mexico the nuts are called "piñons," and to an increasing extent this name is being accepted as applicable to all pine nuts. The pine nut has a rich, marrowy kernel in a shell that varies in thickness from that of a chestnut to that of a hard-shelled hazel nut." *

Pistachio. (*Pistacia vera*).

This nut, although a native of Syria, has long been cultivated in Southern Europe, where it produces a fruit somewhat larger than that of the parent stock, but of a less desirable flavor. Most of the nuts used in the United States are from European countries bordering upon the Mediterranean. The pistachio was introduced into the Southern States nearly half a century ago and has been somewhat widely though not extensively grown. Small quantities of this nut have been successfully grown in California.

The kernel is greenish in color and has a somewhat mild but pleasing and characteristic flavor, suggestive of almonds. In this country it finds its largest use in the manufacture of confectionery, for which purpose it is valued both for its flavor and color.

COMPOSITION OF THE PISTACHIO.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
First quality, edible portion..	6175	....	4.2	22.3	54.0	16.3	3.2	3,235
Second quality, edible portion	6176	....	4.3	22.8	54.9	14.9	3.0	3,262
Average.	....	....	4.2	22.6	54.5	15.6	3.1	3,249

---

* Nut Culture in the United States, p. 92.

DISCUSSION OF RESULTS.

It has been found that the nutritive value of all foods, irrespective of their source or kind, depends upon the presence of one or more of four classes of nutrients. These are called protein (nitrogenous matter), fats, carbohydrates and ash (mineral matter). The gluten of wheat, the lean of meat, the white of an egg and the curd of milk (casein), are all familiar illustrations of protein. These matters differ from other food constituents in that they contain nitrogen. Examples of fats are butter (fat of milk), the fat of meat, the oils of plants and seeds, as olive oil, oil of corn, etc. Carbohydrates consist of starch, sugar and allied substances. They make up the greater portion of such foods as potatoes and corn. Ash is the matter left after burning, and so far as nutrition is concerned, consists chiefly of phosphates and chlorides of lime, potash and soda.

Food has in general two distinct uses in the body: one to build up and repair, the other to supply the energy needed to enable the body to do work, maintain its temperature, etc. The living tissues of the body, with the exception of fatty tissues, are built up entirely from protein and ash. Protein can be used by the body as a source of energy, but the fats and carbohydrates are the chief sources of energy under normal conditions. The body cannot create energy, but is dependent upon the potential energy of its food for the work it does. The food yields up its energy to the body by being burned, just as truly as if it were in a furnace under a boiler.

As above stated, protein can be burned by the body as a source of energy. This, however, is wasteful of protein, as energy is much more economically furnished by fats and carbohydrates. Not only are the fats and carbohydrates burned as a source of energy, but being thus oxidized in the body they partially protect the protein of the food and of the body from being burned.

Since the chief use of protein is to build up and repair the animal body, if it were protected so that none of it were oxidized only a small amount of protein would be needed per day for maintenance of the body. As it is, even with an abundance of fats and carbohydrates in the food, quite considerable amounts of protein are daily oxidized. The amount of protein that is consumed in the body increases to some extent with the amount of external work done. From observation in the respiration calorimeter in feeding experiments and in dietary studies, Atwater estimates that a man at medium work uses daily about 4½ ounces of protein (.28 pounds or 125 grams).

The energy of the body is derived from the potential energy of its food, which can conveniently be measured by its fuel value. The calorie is the unit and is the amount of heat necessary to raise one kilogram of water 1° of the centigrade scale. This is very nearly the same as the amount of heat required to raise 4 pounds of water 1° Fahrenheit. The fuel value of foods can be very accurately determined by means of an apparatus termed the calorimeter. For example, the fuel value of a pound of shelled almonds, as given in the table on page 87, is 3,030 calories. This means that if a pound of this substance were burned, the heat given off would be capable of warming four times that number or 12,120 pounds of water 1° F.

The protein, fats and carbohydrates of the food are burned in the body and their value for this purpose can be best expressed in calories. A person remaining quiet in a temperature near that of the body would theoretically only use sufficient energy to perform necessary vital processes, such as digestion and assimilation of food, circulation of the blood, etc. If the temperature of the air is much below that of the body, more nutrients would need to be burned in order to keep the body warm, and if at the same time, exercise were taken or work of any kind done, added potential energy of the food would be needed to perform this. Atwater estimates that a man at medium work uses daily about 3,500 calories of potential energy which must be supplied by the food. The .28 of a pound of protein in the daily ration would furnish about 500 calories of energy; the remaining 3,000 calories must be furnished in the food in the form of fats and carbohydrates.

The food for a day's ration for a man at medium work should, therefore, supply about .28 pounds of protein and 3,500 calories of energy, or at the rate of 125 calories for each .01 pound of protein. The above facts and estimates make it easier to understand the nutritive value of different food materials and will help in discussing the place of nuts as food.

In the following table there is given the condensed results of the analyses of nuts given on pages 72 to 84 of this bulletin:

AVERAGE COMPOSITION OF NUTS.

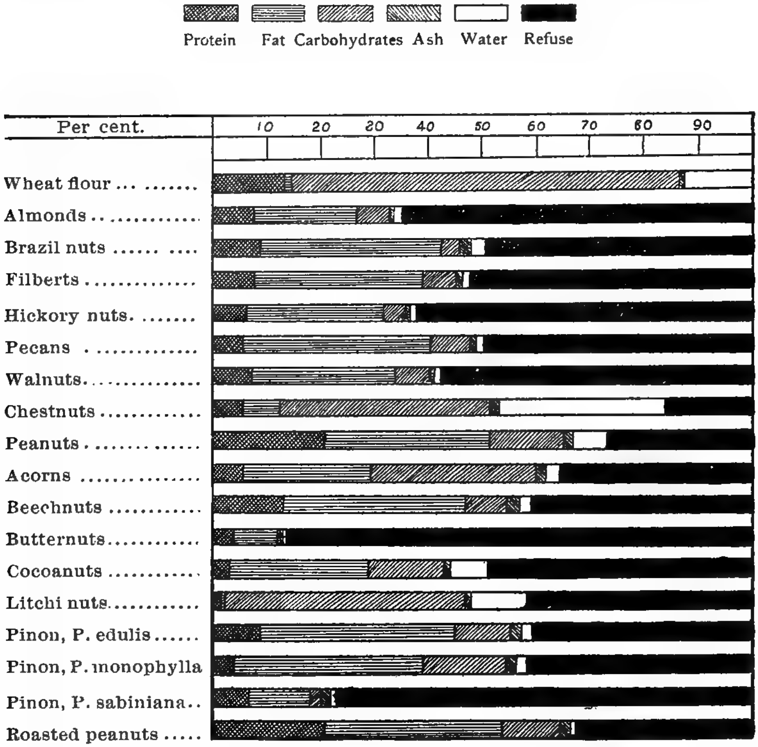
	Number of analyses.	Refuse.	Edible portion.	Edible Portion.					Fuel value per pound.*
				Water	Protein.	Fat.	Carbo-hydrates.	Ash.	
		%	%	%	%	%	%	%	Calories.
Almonds	1	64.8	35.2	1.7	7.3	19.3	6.2	.7	1665
Almonds, kernels	1	.....	100.0	4.8	21.0	54.9	17.3	2.0	3030
Brazil nuts	1	49.6	50.4	2.7	8.6	33.6	3.5	2.0	1545
Filberts	1	52.1	47.9	1.8	7.5	31.3	6.2	1.1	1575
Filberts, kernels	1	.....	100.0	3.7	15.6	65.3	13.0	2.4	3290
Hickory-nuts	1	62.2	37.8	1.4	5.8	25.5	4.3	.8	1265
Pecans	2	49.7	50.3	1.5	5.2	35.6	7.2	.8	1735
Pecans, kernels	2	.....	100.0	2.9	10.3	70.8	14.3	1.7	3445
Walnuts	5	58.0	42.0	1.2	7.0	27.0	6.1	.7	1385
Walnuts, kernels	5	.....	100.0	2.8	16.7	64.4	14.8	1.3	3305
Chestnuts	4	16.1	83.9	31.0	5.7	6.7	39.0	1.5	1115
Acorns	1	35.6	64.4	2.6	5.2	24.1	30.9	1.6	1690
Beechnuts	1	40.8	59.2	2.3	13.0	34.0	7.8	2.1	1820
Butternuts	1	86.4	13.6	.6	3.8	8.3	.5	.4	430
Cocoanuts	1	48.8	51.2	7.2	2.9	25.9	14.3	.9	1415
Cocoanuts, shredded	2	......	.....	3.5	6.3	57.3	31.6	1.3	3125
Litchi nuts	1	41.6	58.4	10.5	1.7	.1	45.2	.9	875
Pinon, P. edulis	1	40.6	59.4	2.0	8.7	36.8	10.2	1.7	1905
Pinon, P. monophylla	1	41.7	58.3	2.2	3.8	35.4	15.3	1.6	1850
Pinon, P. sabiniana	1	77.0	23.0	1.2	6.5	12.3	1.9	1.1	675
Pistachio, kernels	2	......	100.0	4.2	22.6	54.5	15.6	3.1	3010
Peanuts, raw	4	26.4	73.6	6.9	20.6	30.7	13.8	1.6	1935
Peanuts, kernels	4	......	100.0	9.3	27.9	42.0	18.7	2.1	2640
Roasted peanuts	1	32.6	67.4	1.1	20.6	33.1	10.9	1.7	1985
Shelled peanuts	1	......	100.0	1.6	30.5	49.2	16.2	2.5	2955
Peanut butter	2	......	......	2.0	29.3	46.6	17.1	†5.0	2830

* Calculated from analysis.

† Including salt, 4.1%.

In the following diagram the composition of the more important of the nuts is shown, compared with the nutrients of a good quality bread flour.

AVERAGE COMPOSITION OF NUTS AS PURCHASED, COMPARED WITH WHEAT FLOUR.



The first six nuts of the table and diagram are common dessert nuts and resemble each other in many respects. As these are found in the market, from 50 to 65 per cent of the unshelled nuts is refuse (shell). Only 35 per cent of the common almond, 40 per cent of the English walnut and about 50 per cent of the filbert, Brazil nut and pecan is edible. All of these six nuts as purchased contain but little water. The protein in the unshelled nuts runs from 5.2 per cent in the pecan, to 8.6 in the Brazil nut, and in the shelled nuts from 10.3 per cent of protein in the pecan, to 21 per cent in the almond. The fats (oils) form the largest part of the edible portion of these nuts varying from 19.3 per cent in unshelled almonds to 35.6 per cent in pecans. The fat in shelled almonds is 55 per cent and in filbert and walnut meats about 65 per cent and in pecans it makes up 70 per cent of the whole. The carbohydrates, which usually predominate in vegetable foods, occur in only small amounts. A pound of mixed nuts would contain about the following amounts of nutrients and potential energy.

APPROXIMATE COMPOSITION OF ONE POUND OF SIX COMMON NUTS.

	Refuse.	Protein.	Fats.	Carbo-hydrates.	Fuel value.
	Pounds.	Pounds.	Pounds.	Pounds.	Calories.
As purchased	.56	.07	.28	.06	1520
Edible portion	....	.16	.64	.13	324

A pound of good wheat flour contains about .13 pounds protein, .013 pounds of fat, and .72 pounds of carbohydrates, and has a fuel value of 1,600 calories. The meat of the nuts contains nearly fifty times as much fat, less than one-fifth as much carbohydrates, and has double the fuel value. A pound of unshelled nuts would furnish about half as much protein and about the same amount of potential energy as a pound of flour. The potential energy of the nuts is largely from the fats and that of the flour from carbohydrates. For each .01 pound of protein, flour has 123 calories of potential energy or in nearly the same proportions as that demanded by Atwater's standard for a man at medium work. The nuts have 202 calories for each .01 pound of protein and would not make a well balanced food when eaten by themselves. This unsuitableness for a food by themselves is also increased by the potential energy being stored in the concentrated form of fat. This is no reason, however, why nuts should not fill an increasingly large place in dietaries. Very few foods supply the needed nutrients in the proper proportion to form a well balanced ration. Foods rich in fuel constituents need to be combined with other foods of relatively high protein content. The low per cent of carbohydrates in nuts would seem to fit them as one of the sources of food for diebetic and other persons who find it needful to avoid foods containing much starch or sugar.

The chestnut differs materially from the six nuts we have just considered. While the protein content of the unshelled nut is not very unlike the ordinary table nut, it contains only one-fourth as much fat and six or seven times as much carbohydrates. Indeed its high starch content explains why chestnuts are so little eaten raw. Boiling or roasting causes the starch granules to swell and burst, rendering the nut of easier mastication and giving the digestive juices better opportunity to act upon the ingested nuts. A pound of unshelled chestnuts contains .057 pounds of protein and has a fuel value of 1,115 calories or 195 calories for each .01 pound of protein. This is a somewhat more nearly balanced food than the other nuts. As it yields itself readily to cookery, the chestnut should have a more prominent place in American dietaries.

Although the peanut is not a nut strictly speaking, it deserves special attention because of its composition. A pound of roasted peanuts in the shell has .206 pounds of protein, and a fuel value of 1,985 calories, and a pound of roasted and shelled peanuts carries .305 pounds of protein with a fuel value of 2,955 calories. Peanut butter is apparently ground peanuts and has practically the same composition as roasted and shelled peanuts. Peanuts have a fuel value of only 96 calories for each .01 pound of protein and hence have a relative excess of protein. This is so unlike other vegetable foods, with the exception of the near relatives of the peanut, as peas and beans, that it is of great importance. A bushel of raw peanuts weighs about 22 pounds and costs from 75 cents to $1.25. The roasted peanuts retail at from 5 to 10 cents a quart. A quart of peanuts contains as much protein as one pound of rump steak although, at usual prices, the later costs three times as much.

In this country nuts will never to any great extent replace the cereal foods, as is the case in some sections of the Old World. Not only would the original cost prevent, but the labor involved in shelling and preparing nuts for the table would prove a serious obstacle to their extended use. It will, however, be interesting to compare the relative cost of the different nutrients as furnished by different nuts and by wheat flour at the prices which fairly represent the cost in Maine cities.

AMOUNTS OF NUTRIENTS FURNISHED FOR 10 CENTS IN NUTS AT ORDINARY PRICES.

Nuts as purchased.	Prices per pound.	Ten Cents will Pay for—					
			Nutrients.				
		Weight of kernel.	Total.	Protein.	Fats.	Carbo-hydrates.	Fuel value calculated.
	Cents.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calories.
Almonds	15	.23	.21	.05	.12	.04	675
Brazil nuts	12	.42	.38	.07	.28	.03	1370
Filberts	15	.32	.30	.05	.21	.04	1055
Hickory-nuts *a*	9	.42	.40	.07	.28	.05	1405
Pecans	15	.33	.32	.04	.23	.05	1140
Walnuts	15	.28	.27	.05	.18	.04	925
Chestnuts *b*	8.4	1.00	.62	.07	.08	.47	1340
Peanuts *c*	7.3	1.01	.89	.28	.42	.19	2645
Peanuts *d*	14.6	.50	.44	.14	.21	.09	1320
Wheat flour	3.0	....	2.88	.43	.04	2.41	5450

a At 10 cents per quart, 488 grams.
b At 5 cents per quart, 270 grams.
c At 5 cents per quart, 22 pounds per bushel.
d At 10 cents per quart.

DIGESTIBILITY.

There are no reliable data regarding the digestibility of nuts. The belief in their indigestibility seems to be widespread and perhaps has some basis in fact. It is quite probable that if the nuts were properly prepared and eaten at proper times, much of this prejudice would disappear. Our present practice of munching them at odd hours, or as a dessert, when sufficient food has been taken to meet the requirements of the body, overtaxes the digestive organs and places the nut under a reproach that is at least in part undeserved.

Preparation and Use of Nut Foods.

This subject can be treated here in only a very general way. The first difficulty to be encountered is the removal of the shell. With the peanut this is easily accomplished. With many of our nuts, however, the shell is so hard and tough as to discourage the use of large quantities. Some varieties are shelled by machine and the kernels are placed upon the market.

Chestnuts and peanuts when properly prepared furnish palatable and nutritious soups. Peanuts and walnuts, if passed through a meat chopper, or otherwise reduced to a fine state of division, make a butter-like paste which may be used in the preparation of sandwiches. A German dish consists of chestnuts baked with raisins. Salads, croquettes and stuffing for roast fowl may be agreeably diversified by the use of nuts. Commercial preparations of "peanut butter" are on the market and are well received. Desiccated cocoanut is an important article of food. With the exception of the peanut, chestnut and almond, most of the nuts are eaten raw. The nuts, particularly the peanut and chestnut afford interesting opportunities for the housewife skilled in adding to the list of "good things." Attention has been called to the fact that nuts form a very concentrated food. They should, therefore, be eaten with coarser foods and, except in the case of the peanut, with those richer in protein.

CEREAL BREAKFAST FOODS.

CHAS. D. WOODS and L. H. MERRILL.

The general use, at the present time, of cereals on the breakfast table is largely due to the improved condition in which these goods are now offered. Twenty years ago uncooked decorticated oats, (sold under the name of oat meal), graham flour, corn meal, and hominy, all of which required long cooking, made up nearly the entire list of breakfast cereals available to the average housekeeper. Today it is possible to purchase at a moderate price cereal foods which have been previously thoroughly cooked, and subsequently dried so that they will keep indefinitely. These are ready for the table without further cooking or, if wanted hot, can be prepared in a few minutes' time. The process of manufacture is hygienic and cleanly and will bear the closest inspection. Starting from the elevator the goods are cleaned, milled, cooked, evaporated, and packed by machinery. It is very gratifying to find that this class of goods is free from adulteration and careless preparation. The processes differ in different factories and many of them are covered by patents. Some goods may be better prepared than others, just as one flour is better than another; but there is no preparation on the market so far as the writers know, but what is better prepared than anything known to the generation which preceded us.

The tables on pages 94 and 95 contain the description of the samples, including name of goods, name of the maker, place of purchase, the price paid, the weight of the package contents, and the cost per pound. The goods were, with one exception, purchased in Bangor the same day. It was found that the prices at different stores were practically the same for the same goods.

The table on page 96 gives the analyses of these foods calculated to dry matter. The determinations were made by the usual methods, and the heats of combustion were determined by means of the Atwater bomb calorimeter. The fuel value is here given per gram.

The table on page 97 gives the results of the table on page 96 calculated to water content at time of the purchase of the materials. Fuel values as here given are calculated per pound instead of per gram as in the preceding table.

CEREAL FOODS.

Laboratory number.	Name.	Manufacturer.
	CORN PREPARATIONS.	
6230	Crown Flakes	Crown Cereal Company
6231	Hecker's Hominy	Hecker, Jones-Jewell Milling Co.
6232	H-O Company's New Process Hominy	The H-O Company
6233	Mazama	Mazama Health Food Company
	UNCOOKED OAT MEALS.	
6234	A Oat Meal	American Cereal Company
6235	C Oat Meal	American Cereal Company
6245	McCann's Finest Oat Meal	John McCann
	COOKED OAT PREPARATIONS.	
6242	Hecker's Oat Meal	
6244	Hornby's H-O Oat Meal	The H-O Company
6236	American Cereal Company's Rolled Oats	American Cereal Company
6237	American Cereal Company's Rolled Oats	American Cereal Company
6338	Buckeye Rolled Oats	American Cereal Company
6239	Buckeye Rolled Oats	American Cereal Company
6241	Echo White Rolled Oats	Steward & Merriam
6243	Hecker's Rolled White Oats	Hecker, Jones-Jewell Milling Co.
6240	Peoria Rolled Oats	Steward & Merriam
6246	Quaker Rolled White Oats	American Cereal Company
6247	Tip Top Rolled Oats	Akron Cereal Company
	WHEAT PREPARATIONS.	
6264	Fruen's Best Wheat Wafers	Fruen Cereal Company
6263	Fruen's Rolled Wheat	Fruen Cereal Company
6254	H-O Company's Breakfast Food	The H-O Company
6256	Old Grist Mill Rolled Wheat	Potter & Wrightington
6258	Pettijohn's Breakfast Food	American Cereal Company
6249	Cream of Wheat	Cream of Wheat Company
6251	Farinose	American Cereal Company
6252	Fould's Wheat Germ Meal	The Fould's Milling Company
6268	Germea	Sperry Flour Company
6250	Hecker's Farina	
6257	Old Plymouth Breakfast Food	Old Plymouth Cereal Company
6259	Pillsbury's Vitos	Pillsbury-Washburn Flour Mills
6260	Ralston Health Club Breakfast Food	Robinson-Danforth Company
6261	Wheatena	Health Food Company
6262	Wheatlet	The Franklin Mills
6265	Shredded Whole Wheat Biscuit	The Cereal Machine Company
	GLUTEN PREPARATIONS.	
6248	Cooked Gluten	Health Food Company
6253	Dr. Johnson's Glutine	Johnson's Educator Food Store
6269	Whole Wheat Gluten	Health Food Company
	MISCELLANEOUS PREPARATIONS.	
6266	Cook's Flaked Rice	American Rice Food & Mf'g Co.
6229	Glen Mills Standard Crushed Barley	Johnson's Educator Food Store
6267	Grape Nuts	Postum Cereal Company
6286	Malt Breakfast Food	The Malted Cereal Company

CEREAL FOODS, WHERE PURCHASED AND COST.

Laboratory number.	Where purchased.	Price paid per package.	Weight contents of package.	Weight contents of package.	Price paid per pound.
		Cents.	Grams.	Lbs.	Cts.
6230	James H. Snow & Co	5	400	.88	5.7
6231	Fred T. Hall & Co	12	1329	2.93	4.1
6232	J. C. Norton & Co.	13 (2 for 25)	1324	2.92	4.5
6233	Fred T. Hall & Co	15	1136	2.28	6.
6234	Staples & Griffin	In bulk	....	......	4.
6235	Staples & Griffin	In bulk	....	.....	4.
6245	Fred T. Hall & Co	55	2331	5.14	10.7
6242	Staples & Griffin	13 (2 for 25c.)	828	1.83	7.1
6244	Fred T. Hall & Co	15	933	2.06	7.3
6236	Staples & Griffin	In bulk	....	......	4.
6237	Fred T. Hall & Co	In bulk	....	......	4.
6238	James H. Snow & Co	8 lbs. for 25c in bulk	....	......	3.1
6239	T. F. Cassidy & Son	10	849	1.87	5.3
6241	J. C. Norton & Co.	10	895	1.97	5.1
6243	Staples & Griffin	10	874	1.93	5.2
6240	J. C. Norton & Co	4 cts. per lb., 7 lbs. for 25 cts., in bulk	....	......	4.
6246	J. C. Norton & Co	13 (2 for 25c.)	851	1.88	6.9
6247	Staples & Griffin	5	554	1.22	4.1
6264	J. C. Norton & Co	13 (2 for 25c.)	857	1.89	6.9
6263	Staples & Griffin	In bulk	....	......	4.
6254	J. C. Norton & Co	10	578	1.27	7.9
6256	Fred T. Hall & Co	15	952	2.10	7.1
6258	J. C. Norton & Co.	13 (2 for 25c.)	841	1.85	7.0
6249	J. C. Norton & Co.	17	853	1.88	9.0
6251	Fred T. Hall & Co	15	936	2.06	7.3
6252	J. C. Norton & Co.	13 (2 for 25c.)	830	1.88	4.9
6268	J. C. Norton & Co	15	795	1.75	8.6
6250	J. C. Norton & Co	13 (2 for 25c.)	423	.93	14.0
6257	James H. Snow & Co.	15	853	1.88	8.0
6259	J. C. Norton & Co.	13 (2 for 25c.)	951	2.10	6.2
6260	J. C. Norton & Co.	15	857	1.89	8.0
6261	J. C. Norton & Co.	25	992	2.19	11.4
6262	J. C. Norton & Co.	13 (2 for 25c.)	859	1.89	6.9
6265	J. C. Norton & Co	13 (2 for 25c.)	398	.88	14.8
6248	Staples & Griffin	25	416	.92	27.3
6253	Fred T. Hall & Co	25	410	.90	27.7
6269	James H. Snow & Co	55 (5 lbs. bag)	2274	5.01	11.
6266	J. C. Norton & Co	15	387	.85	17.6
6229	Fred T. Hall & Co	15	908	2.00	7.5
6267	J. C. Norton & Co.	15	428	.94	15.9
6286	A. A. Gilbert	15	675	1.49	10.1

PERCENTAGE COMPOSITION OF CEREAL FOODS CALCULATED TO WATER-FREE BASIS.

Laboratory number.	Name of Cereal Food.	Protein.	Fat.	Carbo-hydrates.	Ash.	Fuel value per gram.
	CORN PREPARATIONS.	%	%	%	%	Calo.
6230	Crown Flakes	9.23	.98	89.32	.47	4.359
6231	Hecker's Hominy	9.70	.67	89.17	.46	4.287
6232	H-O Company's New Process Hominy	9.09	.59	89.99	.33	4.321
6233	Mazama	9.66	1.10	88.67	.57	4.368
	UNCOOKED OAT MEALS.					
6234	A Oat Meal	18.76	8.27	70.18	2.79	4.789
6235	C Oat Meal	15.47	8.03	74.46	2.04	4.730
6245	McCann's Finest Oat Meal	13.18	10.59	74.27	1.96	4.773
	COOKED OAT PREPARATIONS.					
6242	Hecker's Oat Meal	20.77	8.11	69.01	2.11	4.829
6244	Hornby's H-O Oat Meal	14.75	8.86	74.30	2.09	4.733
6236	American Cereal Company's Rolled Oats	15.04	8.28	74.44	2.24	4.723
6237	American Cereal Company's Rolled Oats	16.39	8.11	73.38	2.12	4.661
6238	Buckeye Rolled Oats (in bulk)	16.08	8.07	73.64	2.21	4.659
6239	Buckeye Rolled Oats (in package)	15.97	8.16	73.72	2.15	4.718
6241	Echo White Rolled Oats	15.94	8.15	73.74	2.17	4.724
6243	Hecker's Rolled White Oats	15.80	8.91	73.24	2.05	4.783
6240	Peoria Rolled Oats	15.56	8.33	73.92	2.19	4.662
6246	Quaker Rolled White Oats	16.11	9.31	72.44	2.14	4.685
6247	Tip Top Rolled Oats	17.75	8.73	71.29	2.23	4.727
	WHEAT PREPARATIONS.					
6264	Fruen's Best Wheat Wafers	10.43	2.34	85.08	2.15	4.354
6263	Fruen's Rolled Wheat	10.62	2.26	85.18	1.94	4.307
6254	H-O Company's Breakfast Wheat	11.47	1.78	84.70	2.05	4.406
6256	Old Grist Mill Rolled Wheat	10.97	2.08	85.13	1.82	4.401
6258	Pettijohn's Breakfast Food	13.31	2.05	82.79	1.85	4.401
6249	Cream of Wheat	13.14	1.13	85.31	.42	4.372
6251	Farinose	15.59	3.32	79.50	1.59	4.479
6252	Fould's Wheat Germ Meal	12.24	2.61	83.61	1.54	4.325
6268	Germea	14.61	2.70	81.18	1.51	4.473
6250	Hecker's Farina	11.86	1.06	86.58	.50	4.378
6257	Old Plymouth Breakfast Food	14.75	2.47	81.55	1.23	4.458
6259	Pillsbury's Vitos	13.10	1.70	84.48	.72	4.410
6260	Ralston Health Club Breakfast Food	12.16	1.56	85.36	.92	4.379
6261	Wheatena	16.42	3.79	77.89	1.90	4.541
6262	Wheatlet	15.33	2.17	81.23	1.27	4.436
6265	Shredded Whole Wheat Biscuit	11.92	1.64	84.78	1.66	4.396
	GLUTEN PREPARATIONS.					
6248	Cooked Gluten	16.88	3.86	76.80	2.46	4.555
6253	Dr. Johnson's Glutine	15.31	.99	82.53	1.17	4.455
6269	Whole Wheat Gluten	17.89	5.20	73.85	3.06	4.628
	MISCELLANEOUS PREPARATIONS.					
6266	Cook's Flaked Rice	8.89	.16	90.52	.43	4.295
6229	Glen Mills Standard Crushed Barley	11.14	.96	86.76	1.14	4.326
6267	Grape Nuts	12.34	1.14	84.11	2.41	4.357
6286	Malt Breakfast Food	14.54	2.43	81.53	1.50	

WEIGHTS OF NUTRIENTS, AND FUEL VALUE OF ONE POUND OF CEREAL FOODS AS FOUND IN THE MARKET.

Laboratory number.	Name of Food.	Water.	Protein.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.
	CORN PREPARATIONS.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6230	Crown Flakes	.120	.081	.009	.787	.004	1740
6231	Hecker's Hominy	.110	.086	.006	.794	.004	1730
6232	H-O Company's New Process Hominy	.120	.080	.005	.792	.003	1725
6233	Mazama	.107	.086	.010	.792	.005	1770
	UNCOOKED OAT MEALS.						
6234	A Oat Meal	.067	.175	.077	.655	.026	2025
6235	C Oat Meal	.079	.143	.074	.686	.019	1975
6245	McCann's Finest Oat Meal	.051	.125	.101	.705	.019	2055
	COOKED OAT PREPARATIONS.						
6242	Hecker's Oat Meal	.091	.189	.074	.627	.019	1990
6244	Hornby's H-O Oat Meal	.093	.134	.080	.674	.019	1945
6236	American Cereal Company's Rolled Oats	.077	.139	.076	.687	.021	1975
6237	American Cereal Company's Rolled Oats	.069	.153	.076	.683	.020	1970
6238	Buckeye Rolled Oats (in bulk)	.074	.149	.075	.682	.021	1955
6239	Buckeye Rolled Oats (in package)	.080	.147	.075	.678	.020	1970
6241	Echo White Rolled Oats	.082	.146	.075	.677	.020	1965
6243	Hecker's Rolled White Oats	.086	.144	.081	.669	.019	1980
6240	Peoria Rolled Oats	.068	.145	.078	.689	.020	1970
6246	Quaker Rolled White Oats	.081	.148	.086	.666	.020	1955
6247	Tip Top Rolled Oats	.091	.161	.079	.648	.020	1950
	WHEAT PREPARATIONS.						
6264	Fruen's Best Wheat Wafers	.113	.093	.021	.754	.019	1750
6263	Fruen's Rolled Wheat	.106	.095	.020	.761	.017	1745
6254	H-O Company's Breakfast Wheat	.117	.101	.016	.748	.018	1765
6256	Old Grist Mill Rolled Wheat	.112	.096	.019	.756	.016	1775
6258	Pettijohn's Breakfast Food	.107	.119	.018	.739	.017	1780
6249	Cream of Wheat	.106	.118	.010	.763	.004	1775
6251	Farinose	.094	.141	.030	.720	.014	1840
6252	Fould's Wheat Germ Meal	.111	.109	.023	.743	.014	1745
6268	Germea	.115	.129	.024	.719	.013	1795
6250	Hecker Farina	.114	.105	.009	.767	.004	1760
6257	Old Plymouth Breakfast Food	.123	.129	.022	.716	.011	1775
6259	Pillsbury's Vitos	.093	.119	.015	.766	.007	1815
6260	Ralston Health Club Breakfast Food	.121	.107	.014	.751	.008	1745
6261	Wheatena	.086	.150	.035	.712	.017	1885
6262	Wheatlet	.116	.136	.019	.718	.011	1780
6265	Shredded Whole Wheat Biscuit	.108	.106	.015	.756	.015	1780
	GLUTEN PREPARATIONS.						
6248	Cooked Gluten	.089	.154	.035	.699	.022	1880
6253	Dr. Johnson's Glutine	.102	138	.009	.741	.011	1815
6269	Whole Wheat Gluten	.112	.159	.046	.656	.027	1865
	MISCELLANEOUS PREPARATIONS.						
6266	Cook's Flaked Rice	.114	.079	.001	.802	.004	1725
6229	Glen Mills Standard Crushed Barley	.103	.100	.009	.779	.010	1760
6267	Grape Nuts	.053	.117	.011	.797	.023	1870
6286	Malt Breakfast Food	.080	.134	.022	.750	.014	

DISCUSSION.

Corn Preparations.

The first four materials in the table are corn products. They differ comparatively little from corn meal in composition, containing, however, somewhat less fat. The average of 19 samples of granular corn meal as compiled in Bulletin 28 of the Office of Experiment Stations shows that one pound contains .125 pounds of water; .092 pounds of protein; .019 pounds of fat; .754 pounds of carbohydrates and .010 pounds of ash. The only claim that the manufacturers make concerning Crown Flakes, Hecker's Hominy and H-O Company's Hominy is that they are carefully prepared from the best quality of corn and are thoroughly kiln dried, so as to keep well. The low percentage of fat indicates that all of these goods were made from corn from which the germ was more or less removed. The Mazama people make an unwarranted claim on the package. They say, a package "provides, when cooked and ready for the table, 23 pounds of unsurpassed food, sufficient to sustain in health and vigor a family of seven for twenty-four hours." Assuming that the family of seven consists of a man, his wife and five children from two to ten years of age, they would require for their nourishment for one day 1⅓ pounds protein and enough fats and carbohydrates to furnish altogether 17,000 calories. A package of Mazama carries a little more than .2 of a pound of protein and has a fuel value of little less than 4,500 calories.

Uncooked Oat Meals.

The "A" and "C" oatmeals were sold in bulk, being put up in barrels. They differ in composition no more than is to be expected. The "A" oatmeal contains three per cent more protein than the "C." The McCann's oatmeal was put up in a five pound tin can and according to the label was made by John McCann, Drogheda, Ireland. The package carried an analysis by the city analyst of Dublin which differs only slightly from that of the sample here reported. The protein in this meal is considerably less than in American goods. Its high cost is accounted for by the tin package and its being imported goods

It would be difficult to see why anyone should prefer it to American goods.

Cooked Oat Preparations.

Hecker's partly cooked oatmeal (No. 6242) and Hecker's rolled white oats (No. 6243) differ in price and, so far as these two samples are concerned, in composition. The former carries a third more protein than the latter. Very few oatmeals contain so high a percentage of protein as sample No. 6242. Hornby's H-O (No. 6244) carries about the average percentage of protein, althougn on this package there is an analysis which claims 17.63 per cent instead of 13.40 per cent which the sample examined has. The same analysis calls all of the ash phosphates, ("brain and nerves"), which is of course not strictly in accord with fact. The American Cereal Company put their goods up under at least three names and in four forms. Quaker oats are sold only in package, Buckeye oats in package and barrel, and American Cereal Company's oats in bulk. The only apparent difference in the four kinds is the price. The Buckeye oats in bulk retailed in Bangor at 3 1-8 cents per pound, the American Cereal Company's rolled oats in bulk at 4 cents. The Buckeye oats in package cost in Bangor 5.3 cents, and the Quaker oats 6.9 cents a pound. They are all good quality rolled oats, and there seems to be no reason why one should pay 6.9 cents a pound when apparently just as good goods, made by the same company, sell for less than half that price. All of the rolled oats are good goods from the chemical standpoint, and there are no greater differences in composition than one would expect. The goods of different companies differ no more than different samples from the same companies probably would.

Wheat Preparations.

Judging from the protein content of the different wheat preparations is would appear that they are nearly all made from the soft starch wheats. This is an excellent way to utilize wheat relatively low in gluten, which will, in consequence, not make strong flour. For bread flours no wheats are so good as the hard wheats of high gluten content. For one restricted to a diet of wheat products, the hard wheats are more desirable, but in a mixed diet there are other sources of protein, and the use of the softer wheats in mushes and the like is to be encouraged.

Fruen's Wheat Wafers at 6.9 cents a pound and Fruen's Rolled Wheat at 4 cents are apparently the same goods, one put up in paper, the other in barrels. The claims that these preparations are "the most natural food for mankind," "the great nerve, brain and muscle food," etc., are exaggerations, but we are so used to overstatement of facts in advertisements that probably no one is deceived by such claims.

The H-O Company's Breakfast Food claims to be made from California wheat, and the analysis, showing 10 per cent protein and 75 per cent of starch, indicates a soft wheat such as is grown in California.

Old Grist Mill Rolled Wheat is also made "from the finest California white wheat." Pettijohn's Breakfast Food "is made from selected Pacific coast wheat." The sample analyzed carries 2 per cent more protein than most of the above mentioned brands.

Cream of Wheat claims to be "composed almost entirely of pure gluten, is one of the healthiest and most nutritious foods known." It claims also to be "made from the very choicest of selected hard spring wheat and being almost pure gluten, is highly recommended for the use of diabetic persons." The claim that Cream of Wheat is "almost pure gluten" is false and should be criminal. As a food for people in health, Cream of Wheat is all right. Diabetic persons should avoid starch and sugar, and this preparation contains 75 per cent of these carbohydrates.

Farinose, "a pure preparation from Ohio's best amber wheat," is the richest in protein of any of the samples examined and in this respect more nearly resembles the oatmeals.

Fould's Wheat Germ Meal "is made from the glutinous portion of choice wheat." If this statement means (and it is evident that it was intended to convey this meaning) that in its manufacture the starchy part of the wheat is excluded, it is not true. Although made by a patented process, the resulting preparation chemically resembles ordinary white wheat preparations in starch and in protein content.

Germea is "prepared from the choicest California white wheat" by the Sperry Flour Company of San Francisco. The sample examined differs from the average of California wheat products by containing a higher percentage of protein.

Hecker's Farina, judging from appearance and composition, is a finely ground white wheat flour. The only drawback to the goods for the purposes mentioned on the wrapper is the high cost, 14 cents a pound.

The statement that "Old Plymouth Breakfast Food is made from carefully selected *glutinous* wheat" accords fairly well with its analysis which shows it to contain more protein than the most of the other wheat preparations examined. That it "is the most economical of all cereal foods" is not so evident. It costs at retail at the rate of 8 cents per pound, and equally good wheat preparations are sold in bulk at one-half the price.

Pillsbury's Vitos is the "choicest product of carefully selected Northwestern hard spring wheat." The analysis on the package calls for 16.64 per cent of protein, and the sample examined carries only 11.9 per cent. The first analysis corresponds with a hard wheat, while the sample reported bears evidence of having been made from a soft winter wheat. The claimed analysis shows 6.68 per cent of water; the sample examined carried 9.30 per cent.

Ralston Breakfast Food, "a perfect food made from selected wheat rich in gluten," is also apparently made from a soft winter wheat. The sample examined carries 10.70 per cent of protein, and hence could not have been made from a "wheat rich in gluten." It is a well made preparation, but its cost of 8 cents a pound is too high.

The Health Food Company's Wheatena contains the highest percentage of protein of any of the wheat preparations examined by the Station. While some of the claims made by the company for Wheatena are not fully borne out, they do call attention to the fact that it can be used, "in all cases and conditions and by all beings, *except such as suffer from the disease known as diabetes.*" Its high cost, 11.4 cents per pound, prevents its use as an economical cereal food.

"Wheatlet," made from choice selected wheat "especially rich in the nitrogenous elements," is a well prepared food of good composition, carrying a higher per cent of protein (13.6%) than most of the wheat preparations.

There is probably no other cereal food on the market so widely and extensively advertised as Shredded Wheat Biscuit. For the most part its advertising matter is free from exaggerated statements. Its chemical composition is that of good quality winter wheat. It is the highest in price of any of the wheat preparations, costing nearly 15 cents a pound. From this fact it should not have a place upon the table of those who are trying to live economically.

The average composition of the different classes of corn, oat and wheat preparations is compared with milk and a good quality of bread flour in the following table.

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF THE MORE IMPORTANT CLASSES OF CEREAL FOODS AS FOUND IN THE MARKET COMPARED WITH MILK AND FLOUR.

Classes of Foods.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
	Pound.	Pound.	Pound.	Pound.	Pound.	Calories.
Milk	.865	.035	.042	.051	.007	337
Flour	.128	.131	.013	.723	.005	1645
Corn foods	.114	.084	.007	.791	.004	1740
Oat meals	.060	.148	.084	.682	.021	2018
Rolled oats	.081	.150	.078	.671	.020	1965
Wheat meals	.108	.124	.020	.737	.010	1790
Rolled wheats	.111	.101	.019	.752	.017	1765

Miscellaneous Preparations.

Cook's Flaked Rice is "manufactured from the best Carolina head rice." It has practically the same composition as raw rice, but is cooked ready for use. Rice is much lower in protein content than wheat or oats, and more nearly resembles Indian corn in composition. Best Carolina head rice retails for 10 cents a pound. The price asked for the cooked flaked rice in packages makes its cost about 15 cents per pound.

Glen Mills Crushed Barley has about the same composition as bolted barley meal. Its cost, 7½ cents a pound, is about that of the wheat preparations in packages.

Malt Breakfast Food is prepared "from the best barley malt and the choicest wheat." It contains as much protein as the best of the wheat foods. The analysis here reported agrees as closely as would be expected with that on the package.

Grape Nuts, manufactured by the Postum Cereal Company, is "made by special treatment of entire wheat and barley." These goods have nearly the same proximate composition as the wheat foods. Part of the starch has been changed into dextrin and grape sugar. The claims of the makers are preposterous. Grape Nuts "are a condensed food." "Four heaping teaspoons of Grape Nuts are sufficient for the average meal." "The system will absorb a greater amount of nourishment from 1 pound of Grape Nuts than from ten pounds of meat, wheat, oats, or bread." A man at moderate work needs per day about .28 pounds of protein and sufficient fats and carbohydrates in addition to make the potential energy of the day's food 3,500 calories. Four heaping teaspoonfuls of Grape Nuts weigh about 1 ounce. The protein and energy needed for one meal (⅓ of 1 day) and that furnished by 4 heaping teaspoonfuls of Grape Nuts are compared in the following table:

	Protein —lbs.	Fuel value —calories.
Needed for ⅓ day by man at moderate work..	.090	1,175
Furnished by four heaping teaspoonfuls, (1 oz.) of Grape Nuts..........................	.007	117

It would require .77 pounds of Grape Nuts (¾ of a package) to furnish ⅓ of the protein needed for one day for a man at moderate work; the energy needed would be afforded by .63 pounds.

The nutrients of beef are more completely digested and absorbed than those of vegetable foods. There is no reason for thinking that Grape Nuts would be more completely digested than rolled oats, wheat flour or wheat bread. About 85 per cent of the protein and of fuel value of vegetable foods are digested and rendered available to the body. In the following table there are compared the pounds of protein and fuel values of one pound of Grape Nuts with "ten pounds of meat, wheat, oats or bread."

POUNDS OF PROTEIN AND FUEL VALUE OF ONE POUND OF GRAPE NUTS COMPARED WITH 10 POUNDS OF BEEF, ROLLED WHEAT, WHEAT FLOUR, ROLLED OATS AND BREAD.

	Protein —lbs.	Fuel value —calories.
1 pound of Grape Nuts....................	.12	1,870
10 pounds round steak, including bone.......	1.90	8,950
10 pounds beef rump, including bone........	1.29	14,050
10 pounds rolled wheat....................	1.01	17,650
10 pounds bread flour.....................	1.31	16,450
10 pounds rolled oats......................	1.50	19,650
10 pounds white bread....................	.80	12,200

While there is no question that Grape Nuts is a good cereal food, it is difficult to understand why the manufacturers should make claims so absurd and contrary to fact.

Gluten Preparations.

It was the intention to confine this study to the breakfast cereals, but as local physicians were prescribing certain so-called gluten foods for diebetic patients, the three in most common use were analyzed. Gluten preparations, containing as high as 70 per cent of protein, were on the market five years ago, and there are now preparations carrying from 30 to 50 per cent of gluten which can be used with reasonable safety by persons suffering from diabetes. As is seen from the table, the Health Food Company's Cooked Gluten, Dr. Johnson's Glutine, and the Health Food Company's Whole Wheat Gluten carry only a little more protein and a little less carbohydrates than ordinary flour. Samples of flour made from the hard spring wheat of the Northwest not infrequently carry more protein that the sample of Dr. Johnson's Glutine and nearly as much as the two other samples here reported upon. Too much can hardly be said in condemnation of the foisting, by false statements in advertising, such materials upon diabetic patients, imposing upon physicians as well as the public. As articles of food for healthy persons, or for the undernourished, those so-called glutens are excellent, and whole wheat gluten at 11 cents a pound is no more expensive than some breakfast cereals. The two others each cost at retail about 27 cents a pound. The analyses of these materials compared with ordinary bread flour bought by the Station in the open market are given, calculated on dry matter, in the table which follows:

COMPOSITION OF WATER-FREE-MATERIAL OF ORDINARY BREAD FLOUR AND THREE GLUTEN MATERIALS.

	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value.
	%	%	%	%	Calories.
Bread Flour	15.02	1.50	82.91	.57	-
Cooked Gluten*	16.88	3.86	76.80	2.46	4555
Whole Wheat Gluten*	17.89	5.20	73.85	3.06	4628
Dr. Johnson's Glutine	15.31	.99	82.53	1.17	4455

* Made by the Health Food Company.

PECUNIARY ECONOMY.

While the composition of foods would seem to be a matter of prime importance, to the average consumer the cost is a matter of equal importance. An intelligent selection can be made only by considering both factors. In the following table there is shown the amount of the various constituents that can be purchased for 10 cents at the prices mentioned, milk at 5 cents per quart and flour at 3 cents per pound being added for comparison.

A study of the table shows that protein is furnished more cheaply by oat preparations than by those of corn or wheat. The oats also supply fat 10 times as cheaply as the corn products, and 5 times as cheaply as the wheat foods. The carbohydrates are supplied most economically by the corn preparations, oats ranking second. In fuel value, oats again rank first.

If wheat flour be included in the comparison, it will be found to be the cheapest source of protein and carbohydrates. With the exception of one sample of rolled oats, it also leads in fuel value.

AMOUNTS OF NUTRIENTS FURNISHED FOR TEN CENTS IN CEREAL FOODS AT ORDINARY PRICES, COMPARED WITH MILK AND FLOUR.

Name of Food.	Prices per pound.	TEN CENTS WILL PAY FOR—					
		Total food materials.	Nutrients.				Fuel value.
			Total.	Protein.	Fats.	Carbo-hydrates.	
	Cts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calo.
Milk	2.5	4.00	.51	.14	.17	.20	1350
Flour	3.0	3.33	2.88	.43	.04	2.41	5471
Crown Flakes	5.7	1.75	1.54	.14	.02	1.38	3047
Hecker's Hominy	4.1	2.44	2.16	.21	.01	1.94	4221
H-Company's New Process Hominy	4.5	2.22	1.95	.18	.01	1.76	3832
Mazama	6.0	1.67	1.48	.14	.02	1.32	2956
A Oat Meal	4.0	2.50	2.27	.44	.19	1.64	5065
C Oat Meal	4.0	2.50	2.26	.36	.19	1.71	4940
McCann's Finest Oat Meal	10.7	.93	.86	.12	.09	.65	1910
Hecker's Oat Meal	7.1	1.41	1.25	.27	.10	.88	2807
Hornby's H-O Oat Meal	7.3	1.37	1.21	.18	.11	.92	2667
Rolled Oats, American Cereal Company's	4.0	2.50	2.26	.35	.19	1.72	4935
Rolled Oats, American Cereal Company's	4.0	2.50	2.28	.38	.19	1.71	4920
Buckeye Rolled Oats (in bulk)	3.1	3.23	2.92	.48	.24	2.20	6318
Buckeye Rolled Oats (in package)	5.3	1.89	1.70	.28	.14	1.28	3720
Echo White Rolled Oats	5.1	1.96	1.77	.29	.15	1.33	3855
Hecker's Rolled White Oats	5.2	1.92	1.72	.28	.16	1.28	3805
Peoria Rolled Oats	4.0	2.50	2.27	.36	.19	1.72	4928
Quaker Rolled White Oats	6.9	1.45	1.30	.21	.12	.97	2832
Tip Top Rolled Oats	4.1	2.44	2.16	.39	.19	1.58	4753
Fruen's Best Wheat Wafers	6.9	1.45	1.25	.13	.03	1.09	2539
Fruen's Rolled Wheat	4.0	2.50	2.19	.24	.05	1.90	4365
H-O Company's Breakfast Wheat	7.9	1.27	1.10	.13	.02	.95	2243
Old Grist Mill Rolled Wheat	7.1	1.41	1.23	.14	.03	1.06	2501
Pettijohn's Breakfast Food	7.0	1.43	1.26	.17	.03	1.06	2548
Cream of Wheat	9.0	1.11	.99	.13	.01	.85	1968
Farinose	7.3	1.37	1.22	.19	.04	.99	2522
Fould's Wheat Germ Meal	4.9	2.04	1.79	.22	.05	1.52	3558
Germea	8.6	1.16	1.01	.15	.03	.83	2083
Hecker's Farina	14.0	.71	.62	.07	.01	.54	1249
Old Plymouth Breakfast Food	8.0	1.25	1.08	.16	.03	.89	2219
Pillsbury's Vitos	6.2	1.61	1.44	.19	.02	1.23	2919
Ralston Health Club Breakfast Food	8.0	1.25	1.09	.13	.02	.94	2183
Wheatena	11.4	.88	.79	.13	.03	.63	1656
Wheatlet	6.9	1.45	1.27	.20	.03	1.04	2580
Shredded Whole Wheat Biscuit	14.8	.68	.59	.07	.01	.51	1210
Cooked Gluten	27.3	.37	.33	.06	.01	.26	696
Dr. Johnson's Glutine	27.7	.36	.32	.05	.00	.27	653
Whole Wheat Gluten	11.0	.91	.78	.14	.04	.60	1696
Cook's Flaked Rice	17.6	.57	.50	.04	.00	.46	984
Glen Mills Standard Crushed Barley	7.5	1.33	1.18	.13	.01	1.04	2342
Grape Nuts	15.9	.63	.58	.07	.01	.50	1179
Malt Breakfast Food	10.1	.99	.89	.13	.02	.74	

APPLE INSECTS OF MAINE.

F. L. Harvey and W. M. Munson.

Specific directions for spraying the apple for insect and fungous pests have been prepared by one of the writers and will be sent, free of cost, on application to the Agricultural Experiment Station, Orono, Maine. The indiscriminate killing of insects should, however, be guarded against, as all are not injurious. Many are parasites upon the injurious species, or at some period devour their eggs or young.

These beneficial insects should be recognized when seen, and should be protected and encouraged. Attention is particularly called to the ichneumon, syrphus and tachina flies, and to the lady birds and ground beetles, illustrated in plate I. The ichneumon flies have four wings and are related to the wasps and bees. There are numerous minute forms which prey upon the eggs and larvæ of injurious insects, and larger forms that deposit their eggs upon the caterpillars. Syrphus and tachina flies are two-winged insects, the former of which, in the larval stage, devour plant lice, and the latter are parasitic upon the larvæ of other species. The lady birds and ground beetles are carnivorous, feeding upon both larvæ and perfect forms of other insects.

In the following pages only the more important insects injurious to the apple are discussed, and methods of treatment suggested.

EXPLANATION OF TERMS.

An insect with a complete life history passes through four stages; viz., egg, larva, chrysalis or pupa, and imago or mature insect. The egg hatches into the larva—i. e. caterpillar, worm, grub, or maggot, as the case may be; the larva, after a time, changes to the pupa or chrysalis, which is the inactive or resting state, and may be naked or enclosed in a cocoon; the pupa, after a longer or shorter period, develops into the imago or perfect insect.

A. INSECTS AFFECTING THE TRUNK AND BRANCHES.

THE ROUND-HEADED APPLE TREE BORER. *Saperda candida,* Fabr.

The round-headed borer was first recorded in 1824 by Thomas Say, but was doubtless a native of America, widely distributed at that time, though unnoticed. While it prefers the apple, it also affects the native crab apple, sugar pear, thorn bush, pear, quince, and roundwood.

Description.

Eggs.—Minute, yellowish white.

Larva.—When full grown about one inch long; footless, yellowish white. Head small, chestnut brown, polished, hornlike; jaws two, black; the second joint large and broad, the next two narrow. Rings of the body (segments), from the fourth to the tenth inclusive, armed on the upper side with two fleshy warts.

Pupa.—Lighter colored than the larva and with transverse rows of minute spines on the back.

Perfect Insect.—A beetle, about three-fourths of an inch long, with two broad white stripes extending from the head to the ends of the wing cases; cinnamon brown above; hoary white below; legs, antennæ and face whitish.

Life History.

The eggs, according to Mr. Chas. Pope, who has gathered hundreds of them, are laid in a short slit, made by the beetle with the ovipositor, in the smooth bark. Sometimes the eggs are laid in the bottom of the slit next to the wood, but generally in an opening made in one side of the slit, half way through the bark. Several eggs, sometimes ten or a dozen, are laid on the same tree, being distributed around the trunk usually within six inches of the ground, but occasionally higher and sometimes at the base of the limbs. They are deposited from June to September, in Maine. The egg soon hatches and the young larva gnaws its way into the inner bark and sap wood. When winter comes the young borer works its way, in the wood, below the surface of the soil. In the spring it ascends and passes the second summer in the sap wood. It spends the second winter below the surface of the soil, as it did the first. The third summer it ascends and bores deep channels in the wood in every direction and finally bores upward and outward, nearly to the bark, lines the cavity with borings and transforms to the pupa. The third spring it emerges, deposits its eggs, and the cycle of life is complete.

Vulnerable Points and Remedies.

The eggs are laid in the bark, in plain view, and can be readily detected and taken out. The young larvæ are readily located by the flow of sap from the wound they make, and by the chippings they push out of the mouth of the borings.

The perfect insect may be prevented from depositing eggs by the application of repellants to the trunk of the tree, e. g., tarred paper, or a mound of earth. Soft soap, or whitewash, applied to the trunk of the tree in June and July, is said to prevent the beetle from laying her eggs on the trees thus protected. The trees should be examined twice each year, in May and September, and the young larvæ removed. Should any escape, and penetrate deeply into the wood, they may be destroyed by probing with a sharp wire.

THE FLAT-HEADED APPLE TREE BORER. *Chrysobothris femorata,* Fabr.

This insect, a native of America, is common in Maine. Besides the apple, it is known to attack the pear, plum and peach, also the oak, box-elder, hickories and maples. The injury attributed to the round-headed borer is often due to it.

Description.

Eggs.—Pale yellow, varied, with one end flattened, irregularly ribbed.

Larva.—Soft, flesh-like, pale yellow; head small, deeply set; jaws black; third segment twice as broad as any of the posterior ones, and bearing on its upper surface a large, oval, callous-like projection, covered with numerous raised brown points.

Pupa.—Lighter colored than the larva and with transverse rows of minute spines on the back and a few at the extremity of the body.

Perfect Insect.—A beetle, variable in size but usually about one-half inch long, oblong-flattish in shape, of a dark, dull greenish color with a coppery reflection; under side and legs brilliant copper color; feet green. On each wing case are two irregularly oblong spots of deeper copper color than the remainder of the wing, dividing the wing cases into three nearly equal portions. The upper surface appears as though sprinkled with an ash-colored powder.

Life History.

The beetle makes its appearance in June or July in our latitude. It loves the light and may frequently be seen about the orchard on the trees. It is very active and hard to catch, quickly taking wing. It lays, probably, about one hundred eggs.

The female fastens her eggs, singly or in groups, to loose flakes of bark, or in the crevices, by means of a glutinous substance. The eggs soon hatch and the young larvæ gnaw through the bark and live on the sap wood, making flat channels next to the bark, sometimes girdling the trees. As they get older they bore upward into the solid wood and, when ready to change to the chrysalis, gnaw to the bark and nearly through it. They then change to the chrysalis, and in about three weeks the beetles come forth. The larvæ attack the trunk and larger branches and remain in the tree but one year.

Vulnerable Points and Remedies.

Same as for the round-headed borer.

THE OYSTER-SHELL BARK LOUSE. *Mytilaspis pomorum,* Bouché.

The oyster-shell bark louse is a native of Europe and was introduced into this country, on nursery stock, about a hundred years ago. It is widely distributed, and is exceedingly common in Maine. The twigs of apple trees are often literally covered with the scales, causing great injury. Besides doing great damage to apple trees, this scale is found on the pear, plum, cultivated and wild currant, roundwood, dog wood, and several other shrubs and trees.

Description.

Eggs.—White, changing to yellowish or reddish with age, oblong, about .01 inch long; from 20 to 100 under each scale.

Young females.—Wingless, white and about .01 inch in length, move about quickly, appearing on the branches as small white specks which finally attach themselves, by their beaks, to the new shoots, where the scale is perfected.

Scale of female.—Wingless, about .08 of an inch long, narrow, widened at the posterior end, curved and shaped somewhat like an oyster shell. Brown or grayish, closely resembling the bark in color. Most frequently placed with the small end toward the tip of the twig.

Scale of male.—Much smaller than the female, wedge shaped and straight; usually placed on the leaves and rarely seen. The male insect undergoes a complete metamorphosis, and in the perfect form is provided with two wings.

Life History.

The eggs hatch late in May or early in June. If the weather is cold, the lice remain under the scale until warm weather, when they may be seen running about the twigs for a location to attach themselves. The most of these fix themselves around the bases of the side shoots of the twigs, by means of their tiny slender beaks, and live upon the sap of the tree. They gradually undergo changes. Before the close of the season the louse secretes the scale under which it lives and perfects itself. By the middle of August the female becomes a bag of eggs, which are deposited in a mass under the scale, the body of the louse shriveling, as the eggs are laid, until it is a mere speck at the small end of the scale. These eggs remain under the scale, if not destroyed, until the following spring and then hatch, completing the life history.

How this pest is spread from tree to tree is not well made out, but it is supposed that birds carry them on their feet and that large insects may transport them or that the wind may blow the young about. They are probably introduced into young orchards on the nursery stock and multiply.

Remedies.

During the winter examine the twigs and scrape off the scales, after which, wash with a strong solution of caustic soda or washing powder, applied with a stiff brush. In June, while the lice are still active, spray with an alkaline solution, or better, with kerosene emulsion.

There are several natural enemies which help to keep the insect in check. One of the most important of these is a species of mite, which preys upon the louse as well as upon its eggs. This mite is so small as to be seen only with a microscope.

Another important aid in controlling this pest is the twice-stabbed lady-bird. Both larva and perfect beetle devour large numbers of the lice. The mature form of this insect is readily recognized by its polished black wing-cases with a blood-red spot on each.

THE PEAR-BLIGHT BEETLE, OR SHOT-BORER. *Xyleborus pyri*, Peck=*X. dispar*, Fabr.

This is a native species that attacks hemlock, beech, oak, and cedar, and has transferred its depredations to apple trees in Maine. We have received from several localities specimens of apple limbs that were literally honeycombed with small channels that extended through the laburnum and heart wood to the center. The young larvæ bore into the wood, making deep channels which in small twigs interfere with the circulation of the sap, and the twigs wither, giving the appearance of blight, hence the name pear-blight beetle. The work of this beetle should not, however, be confounded with the pear-blight proper, which is caused by bacteria. The exit holes through the bark were .06 of an inch in diameter and nearly circular, looking like small shot holes. The wood was green, showing that the insect attacks the growing tree. Living wood does not appear to be essential to the life and comfort of this species, for after a period of several weeks we found in a limb that had been in a dry place in a box, young larvæ, full grown larvæ, pupæ, and perfect beetles.

Description.

So far as we know, the eggs have not been described. They must be very small and are said to be laid at the bases of the buds. We have never seen them.

When the larvæ are full grown they transform to pupæ in the burrows, and finally emerge as small beetles about one-tenth of an inch long and of a dark brown or nearly black color, with the antennæ and legs of a rusty red. The thorax is short, very convex, rounded and roughened. The wing covers are marked by longitudinal rows of punctures. The hind part of the body slopes abruptly. The beetles leave their burrows in July and deposit eggs before August.

Remedies.

As the beetles work wholly under the bark they cannot be reached by insecticides. The only way is to watch the trees during the latter part of June and July and, if blighted twigs or diseased limbs are noticed, examine the branches for small pin holes; if found, the presence of this or some related species may be suspected. The diseased limb should at once be cut far enough below the injury to include all the burrows, and burned, to prevent the beetles emerging and attacking new trees. As these beetles live in forest trees, orchards near timber are more liable to become infested.

THE WOOLLY LOUSE OF THE APPLE. *Schizoneura lanigera,* Hausm.

Two forms of this insect are recognized by entomologists. One, known as the apple-root plant-louse, attacks the roots, producing wart-like excrescences or swellings. The other form, known as the woolly louse of the apple, is the one found in Maine. It feeds upon the sap of the trunk and branches. The two are regarded as the same species, living under different conditions. The above ground form occurs most abundantly, in this country, in New England. Entomologists differ in their opinions regarding its nativity; some accredit it to America; most are inclined to think it originated in Europe, where it is much more destructive than in this country.

This insect, in the root form, was noticed in this country as early as 1848, when thousands of trees were found so badly infested that they had to be destroyed. Since then the insect has been reported as doing more or less damage in every section of the country. The pest is distributed upon nursery stock, and the importance of carefully examining nursery stock before setting is strongly urged.

Description and Life History.

The eggs, which are very minute, are laid in the crevices of the bark at or near the surface of the ground.

The young when first hatched appear like specks of mold, being covered with fine white down. As they get older, the cottony covering becomes more distinct, apparently issuing from the pores of the skin of the abdomen and attaining considerable length. The young have beaks longer than the body and, when grown, this organ is fully two-thirds the length of the body. By means of the beak, they attach themselves to the roots or branches, and when abundant, draw heavily upon the vitality of the tree, or may even kill it.

When full grown the females are about one-tenth of an inch long, oval; head and feet black; legs and antennæ dusky; abdomen yellowish; body covered with white mealy powder; a tuft of long, easily detached down upon the hinder part. Under each patch of down is usually found a female and her young. During the summer the females are wingless and the young are produced alive. Toward the fall the broods contain both winged females and winged males, which have not much down on them and are plump and nearly black. The fore wings are about twice as long as the narrow hind ones. These winged females fly about to other trees and lay eggs, establishing new colonies. During the early part of the season this form of the insect is found in clusters about the base of the trunk, upon suckers or twigs springing from the trunk, but in autumn they commonly attack the axils of the leaves and sometimes cover the whole under surface of the limbs and trunk, making the tree look as though whitewashed.

Remedies.

In early spring wash the tree with a strong solution of soft-soap or washing powder. Later in the season spray with kerosene emulsion.

B. INSECTS AFFECTING THE FOLIAGE.

THE BUD MOTH. *Tmetocera ocellana,* Schlieff.

This is probably one of the worst pests to apple orchards in Maine. It works in the unfolding flower and leaf buds of orchard trees, often doing great damage to the crop, besides attacking nursery stock and young trees. It seems to be on the increase in Maine and did much damage in the season of 1899. It is an European insect but is now widely distributed in the northern U. S. and Canada. Besides the apple, it feeds upon the pear, plum, cherry, quince and peach trees, and in Maine has been bred from blackberry plants.

Description.

Eggs.—Disc-shaped, transparent, flattened, usually oval or sometimes circular in outline. The center of the disc elevated, the outer flat rim attached to the leaf.

Larva.—When first hatched, greenish, with head and first thoracic segment black. It molts four times before hibernating. The half-grown caterpillar, which appears on the buds in spring, is about one-sixth of an inch long, brown, with a black head, thorax, shield and legs. When full fed, about the last of June, it changes to the pupa stage within a tube of dead leaves.

Pupa.—Light brown, about a quarter of an inch long. On the back of each abdominal segment are two transverse rows of teeth directed backward.

Perfect Insect.—A moth with three-fifths inch spread of wings. It may be known by the ash-gray color of the fore wings, which are banded across the middle with a cream white band.

Life History.

The half-grown, brown, hibernating caterpillars usually emerge from winter quarters about the time the buds begin to expand, their first appearance depending on the advance of the season, and ranging over two or three weeks. When they are out early, they gnaw into the buds. If the buds are open they crawl inside. They attack both flower and leaf buds, fastening the parts together with silken threads, forming a nest, within which they feed upon the enclosed tender flower or leaf parts. They do not confine their depredations to a single leaf or flower in the bud, but increase the injury done by sampling nearly all. They sometimes bore down the stems a few inches, killing the terminal shoots. The bud attacked turns brown, making the nest conspicuous. The caterpillars feed mostly at night for six or seven weeks and molt three times. When full grown the caterpillar forms a tube out of leaves, which it lines with thin, closely woven silk, and within it soon changes to the pupa. In about ten days the pupa works its way nearly out of the tube by the hooks on its back. The skin splits open and the moth appears. The moths are on the wing during the latter part of June and the first of July. They fly mostly at night, resting on the trees during the day time, when they are easily detected by the white bands on the wings. They live two or three weeks, during which time they mate and the eggs are laid. The eggs, which resemble small fish scales, are laid singly or in clusters, mostly at night, on the under side of the leaves. The eggs hatch in seven to ten days. The young larvæ feed upon the epidermis of the leaf, forming a silken tube for protection. After the fourth molt, which occurs the last of August or the first of September, or before the leaves fall, they leave the silken tubes and form a silken winter home (*hibernaculum*) on the smaller twigs near the buds, in which they spend the winter. The appearance of the hibernating larva in the spring completes the cycle of life.

Remedies.

Pull off and crush the withered clusters of leaves containing the caterpillars and chrysalids early in spring.

Spray with Paris green or with Bordeaux mixture and Paris green, as soon as the buds begin to swell in the spring.

THE OBLIQUE-BANDED LEAF ROLLER. *Cacœcia rosana,* Harris.

This is a native species, reported from several localities in the United States, and one of several species responsible for the destruction of the buds and foliage of apple trees. We have bred it from the leaves of the apple, currant and strawberry in Maine. It also feeds upon the plum, pear, peach, cherry, rose, and a great variety of other trees and shrubs.

Description.

Eggs.—So far as we know, the eggs have not been described.

Larva.—Length .8 of an inch; livid green when young, becoming yellowish green, reddish or brownish with age. Head oval, top of first segment yellow or brown; usually a darker green stripe along the back. The posterior half of the segments wrinkled transversely, and bearing a few minute tubercles from which single hairs arise. When mature the larva spins a silk lining to the leaf in which it lives and changes to a chrysalis of a dark brown color from which emerges the moth.

Perfect Insect.—A short, broad, flat, bell shaped moth, with about one inch spread of wing. The wings pale, reddish brown, crossed with wavy, pale brown lines and with three oblique darker brown bands, one of which covers the base of the wings, another the middle and the third a triangular spot on the front margin near the tip.

Life History.

As soon as the leaves start, the caterpillars begin to coil up and fasten together the young leaves which they feed upon, and in which they find shelter. They attack the buds, leaves and also the young fruit, gnawing its surface or eating deep holes into it. They are full grown the last of June or early in July, when each lines its leaf house with silk, and changes to the chrysalis, from which the moth emerges the last of July. There is a second brood in August. We know nothing of its egg laying habits, or how or where it spends the winter.

Remedies.

The same remedies may be used for this insect as for the bud moth.

THE LESSER APPLE LEAF FOLDER. *Teras minuta*, Robr.

This is another of the small moths that do damage to the buds and leaves of the terminal shoots of the apple tree. It is particularly bad in Maine. It is said to be specially bad in nursery stock, and young orchards, but large trees also suffer. This is a well known cranberry insect and may get into orchards from the bogs.

Description.

Eggs.—The eggs, so far as we know, have not been described.

Larva.—A small, greenish yellow, active caterpillar, with a pale brown head. When disturbed it seeks the more secluded parts of its burrow, or if too much molested, wriggles out and drops to the ground.

Chrysalis.—Within the folded leaf, the larva spins a silken web and changes to a brown chrysalis, three-tenths of an inch long. There is a characteristic knob-like projection from the head end of the chrysalis.

Perfect Insect.—A small moth, with one-half inch spread of wing. There are three broods and the insect is dimorphic, the moths of the third brood being very different in color. These dimorphic forms were thought to be different species until carefully bred and studied. The moths of the first two broods have the head, thorax and fore wings a bright orange color; the hind wings, body and legs are whitish with a silken lustre. The moths of the third brood have the fore wings of a uniform ash-gray, or slate color with reddish luster by oblique light; hind wings light colored and semi-transparent.

Life History.

The gray-colored moths of the third brood hibernate in some sheltered place during the winter. In the early spring they come forth and deposit their eggs on the buds or unfolding leaves. The eggs hatch in a few days and the larvæ crawl between the unfolding leaves and begin feeding upon them, often fastening one or more leaves together by a silken web and living within them. They live upon the epidermis and pulp, but sometimes gnaw holes in the leaves, and sometimes forsake the nest, to feed on adjacent exposed leaves. When mature they spin a silken lining to the leaf and change to the chrysalis, where they remain about a week, and early in May the orange-colored moths of the first brood come forth. The larvæ of the second brood appear the last of May or early in June, and the moths the last of June or in July. The moths of the third brood appear in August, and hibernate, completing the round of life.

Vulnerable Points and Remedies.

The young larvæ of all the broods are exposed when they first hatch and before their leaf shelter is made. The same remedies apply to this insect as to the bud moth.

THE FOREST TENT CATERPILLAR. *Clisiocampa disstria,* Hübner.

There are two tent caterpillars in the eastern United States; the apple tree tent caterpillar, *Clisiocampa Americana,* and the forest tent caterpillar, which was called by Prof. Harris *Clisiocampa sylvatica,* but in recent literature is known as *Clisiocampa disstria.* Both species are common in Maine but are often confounded. Though similar in their life history, they are readily separated by differences in the egg clusters, caterpillars and moths.

Distinguishing Characteristics.—Egg clusters of this species, the same diameter throughout, docked off squarely at the ends; caterpillars with a row of spots along the back; oblique lines on the wings dark colored; web inconspicuous, closely attached to the limbs or trunk and easily overlooked. Insect restless, wandering from tree to tree. Occurs in orchards but, being a general feeder, is more commonly found on forest or shade trees, from which habit it receives its common name.

Description.

Eggs.—The egg clusters, composed of about 300 to 400 eggs, are attached to the terminal twigs of the food plant. They are of the same diameter throughout and cut off squarely at the ends. The eggs are creamy white, rounded at the base, enlarging upwards, narrowing again at the top and terminated by a circular rim on the border and a sunken spot in the center. They are held to the twig and to each other by a brown varnish, which also covers the egg clusters, protecting them from the weather and probably from their enemies.

Larva.—The eggs hatch in the early spring, usually about the time the buds are bursting. The time, however, varies with the exposure of the egg clusters to the sun, and also with the season. In Maine they are hatched the last of April or early in May. Sometimes, during continued warm weather, the eggs hatch before the leaves start, and cold weather comes on afterwards. The young larvæ are very hardy, however, and are not often killed. We have kept them alive in breeding cages for three weeks without food. They will eat the varnish on egg clusters. As soon as hatched they spin a web wherever they go, possibly to enable them to retrace their steps. Soon the branches are lined with these silken paths along which they travel in search of food. They shed their skin (molt) four times, changing color and markings in the first three. They are full fed in about six weeks, though the growth may be hastened or retarded by the weather or food supply. At this time they may be seen wandering about for a suitable place to spin their cocoons.

Cocoon.—The larva spins a whitish-yellow cocoon, resembling that of the apple tree tent caterpillar, and by preference folds it in a leaf, but often attaches it to loose bark or about fences, houses or other places of concealment. Inside of the cocoon the caterpillar changes, in two or three days, to the chrysalis. In two or three weeks the moths emerge.

Perfect Insect.—A brownish yellow moth, expanding an inch and a half or more. The fore wings marked by two oblique brown lines, the space between them usually darker than the rest of the wing. The moths eat nothing. After they have mated and laid their eggs, they die, completing the life history.

Remedies.

(a) Collect the egg clusters in winter when the trees are bare.

(b) While young the caterpillars can be destroyed by spraying with Paris green, but when half grown the amount of poison they get in feeding will not kill them.

(c) After the third molt, they collect in bunches, on the trunks and branches, and can be reached by hand or by spraying. A solution of one pound of washing powder in four or five gallons of water, applied to the bunches by means of a swab attached to a long pole, has proved effectual.

(d) After the caterpillars begin to collect in bunches, or even before, spread a sheet of canvas under the tree. Climb the tree and with a padded mallet suddenly jar the branches on which they rest, and they will fall on the canvas and can be swept up and destroyed. This method is applicable to both orchard and shade trees, and would recommend itself to town authorities, as by the employment of a few men for a few days in June, in Maine, the shade trees could be protected.

(e) Put bands of cotton, or of tarred paper bearing a ring of a mixture of equal parts of sulphur and lard, around the trees, or use any other practical method to prevent them from ascending the trees. In our own experience a band of paper covered with the lard and sulphur mixture has proved an absolutely effectual barrier.

(f) The moths are night fliers and are attracted by electric lights and many are probably destroyed this way. The caterpillars, cocoons and moths should be destroyed by hand whenever possible.

(g) The city of Rochester, N. Y., has successfully enlisted the services of the school children in protecting the city shade trees. Pride in one's city adornment could be thus stimulated in pupils, and by collecting the egg clusters, caterpillars, cocoons and moths, a valuable and practical lesson in nature study would be learned. It would pay town authorities to offer a small bounty, if need be, to stimulate the collecting. All specimens collected should be burned.

Remarks.

For a fuller consideration of this insect and illustrations of all the stages in its life history, the reader is referred to Maine Experiment Station Report, 1888, p. 164; 1889, p. 188; 1890, p. 138, and 1897, p. 173; or to the Maine Agricultural Reports of the corresponding years.

THE APPLE TREE TENT CATERPILLAR. *Clisiocampa Americana,* Harris.

This insect is a native of North America and occurs wherever apples are grown. It has given more or less trouble to apple growers since the early settlement of the country. While it prefers wild cherry, and selects the apple as second choice, it feeds upon plum, peach, rose, and other members of the rose family; also upon the oak, poplar, willow, birch, witch hazel, beech, etc.

Description and Life History.

Eggs.—Dull gray; the upper end circular with a dark spot in the center. They are laid in clusters round the twigs and covered with varnish to protect them from the weather. There are from fifty to two hundred and fifty in a bunch.

Larva.—When first hatched they are dull black and sparsely covered with gray hairs. They appear about the time the leaves start, but if ahead of them, may feed for a time upon the varnish covering the eggs. They molt about six times. The larvæ soon begin to spin a web which increases in size by additional layers of silk as the worms grow, until it is sometimes ten inches or more across. The worms remain in the tent at night, during stormy weather and when not feeding, unless the weather is warm, in which case they may often be seen upon the outside, literally covering the web. They march in military order twice a day from the nest to feed, once in the morning and once in the afternoon.

They pave their roads with silk and follow along them to the leaves. When mature, each worm will consume two leaves a day and an average of five hundred leaves would be required for a colony. There are often several webs in a tree. The effects are to rapidly defoliate the tree and draw heavily upon its vitality to produce new leaves. The caterpillars require about six weeks to mature and are then about an inch and three-fourths long. The worms have a "white line along the back, then a yellow line dotted with black, then a black stripe marked with blue and yellow dots, then a wavy yellow line dotted with black, then a blue stripe dotted with yellow, then a broken white line; head black, under side of body black, the body covered with yellowish or whitish hairs." When mature the larvæ leave the tree and wander about in search of a place to spin their cocoons. They prefer the loose bark of trees, or the under side of fence caps, and will enter sheds and porches and climb the sides of houses and transform under the edge of clapboards, window caps and eaves. When the orchard is near they become a nuisance by entering the house.

Cocoon.—Oblong oval, light yellow, formed of a loosely woven, outer covering and a dense, tough, inner coat. The larva enclosed becomes a brown chrysalis and in about three weeks the moth appears.

Perfect Insect.—A moth of a pale, dull, reddish or reddish-brown color. The fore wings crossed by two oblique, parallel, dirty-white lines. The female is larger than the male. The male has feathery antennæ. The moth has no mouth and takes no food and lives only a few days. Its office is to lay the eggs.

Remedies.

Most of the remedies suggested for the forest tent caterpillar are equally valuable in controlling this insect. As this species does not migrate, the jarring and the protective bands are useless.

THE FALL WEB WORM. *Hyphantria cunea,* Drury.

The fall web worm is a native insect which has from time to time done great damage to forest and fruit trees. It is a general feeder, having been observed to feed upon over one hundred different species of trees, shrubs and herbs. It makes a web which is sometimes very conspicuous, attaining dimensions of several feet. The web can readily be told from that of the apple tree tent caterpillar.

We found this insect abundant in western Maine on July 5 when the webs were already quite conspicuous. In "Forest Insects," issued from the U. S. Department of Agriculture, Dr. Packard, on page 244, says: "The name fall web worm is most expressive for New England and other northern states where the insect is single brooded, appearing there during August and September, while in more southern regions it is double brooded." Though we have not traced this insect through its life history in Maine, and cannot positively say that there are two broods, yet the fact that the webs were conspicuous and the larvæ fully three-fourths of an inch long early in July, would indicate two broods in western Maine.

Description.

Egg.—About one-sixth inch long, bright golden yellow, globular, ornamented with numerous regular pits, which, according to Packard, give it, under the magnifying lens, the appearance of a beautiful golden thimble.

Larva.—Pale yellow when young, with two rows of black marks along the body, a black head and sparse hairs. Full grown larva usually pale yellowish or greenish with a broad, dark stripe along the back and a yellowish stripe along the side, covered with whitish hairs that spring from black and orange yellow warts. The caterpillars are somewhat variable as to depth of color and marking, even on the same tree. The fall brood is generally darker colored than the spring brood.

Cocoon.—Thin, almost transparent, composed of a slight web of silk intermixed with a few hairs from the caterpillar, or sometimes mixed with sand when the cocoon is spun in the soil.

Pupa.—Length .6 inch, breadth in the middle, .23 inch; dark brown, smooth, polished, faintly punctuate, and bulged a little all around in the middle.

Perfect Insect.—A moth which varies greatly in size and color. These color varieties have received different names by entomologists, but are now reduced to *H. cunea,* Drury. The most common form is white or slightly fulvous with white wings, but the wings show variations from pure white to those profusely dotted with black and brown. Front thighs tawny yellow, sometimes marked with a large black spot; feet blackish; expanse of wings one and one-fourth to one and two-thirds inches. Male moth usually smaller with the antennæ doubly feathered beneath. The antennæ of the female possesses two rows of minute teeth.

Life History.

The female deposits her eggs in clusters, laid in regular rows or smaller irregular patches, on either side of the leaves, usually near the end of a branch. Each female lays on an average about five hundred eggs. Those for the first brood are deposited by the last of May or during June, and the time required for them to hatch depends upon the weather. Under favorable circumstances they mature in about ten days, or those of the second brood in eight days. As soon as the caterpillars hatch they spin a small silken web which soon becomes conspicuous. Under this they feed together, upon the upper surface of the leaves. As they grow, other leaves and branches are included until the web reaches considerable size and contains dead leaves and the molt skins of the larvæ. If their food supply gives out, they quit the web and drop to the ground and crawl directly toward other trees with almost unerring instinct, or, when disturbed, let themselves down by a thread and by this regain the tree when the danger is past.

When full grown they are nearly two inches long and leave the web and wander about for suitable places to spin their cocoons. They select crevices in bark, the angles of tree boxes, rubbish about the base of trees, and other similar situations, while the fall brood prefer to bury themselves in the earth if possible, but adapt them elves to circumstances. They soon spin their cocoons. The pupæ contained in these hatch into the second brood of moths about the first of August, and the moths lay eggs which hatch into caterpillars that feed, mature, and spin their cocoons during August and September. The insects invariably spend the winter in the chrysalis state in the cocoon, and the following spring the moths emerge and lay their eggs, thus completing the life history.

Remedies.

Spray with Paris green before the insect makes much headway. If there are but few webs on the tree, cut off the branches and burn. Another effective remedy is a strong alkali, whale oil soap, or washing powder solution applied with a swab.

There are several predaceous insects which attack the larvæ, the most important being the spined soldier bug, *Podisus spinosus* (Dallas).

THE LIME TREE WINTER MOTH. *Hybernia tillaria,* Harris.

This is a native species often associated with the fall canker worm, which it resembles very much in its life history. It seems to remain and do damage when the fall canker worm has disappeared.

Description.

Eggs.—Pale yellow, oval and marked with a network of raised lines. They can be distinguished from the eggs of the canker-worm by their color and form. (See Report Maine Experiment Station, 1888, p. 167, Fig. 20).

Larva.—When full grown, about an inch and a quarter long; head dull red with a V-shaped mark on the front; yellow above and marked with many longitudinal black lines; the under side paler. Like the larva of the canker worm, it is a span or inch-worm, but it is larger than the caterpillar of that species.

Female Moth.—Wingless, spider-like, yellowish white; sides marked with black dots. Each ring of the body, excepting the last, which has only one, bears two black dots. Head black in front; antennæ thread-like. Ovipositor jointed and retractile; legs ringed with black. The larger size, the spotted back, and the black rings on the legs readily distinguish this from the wingless females of the fall and spring canker worms.

Male Moth.—Expanse of fore wings an inch and a half; color rusty buff, sprinkled with brownish dots and with two transverse, brown, wavy, lines, the inner most distinct. Between the bands and near the anterior edge is usually a brownish dot; hind wings paler; body color of fore wings; antennæ feathered. Like most of the moths of the inch worms, the wings are very delicate. The moths of the canker worm are on the wing at the same time, but they are smaller and are thus readily distinguished.

Life History.

The eggs, which are laid in situations similar to those of the canker worm, hatch early in the spring and the young larvæ feed upon the foliage of the apple tree, basswood, elm, hickory, etc., and when full grown, about the middle of June, they usually let themselves down by a silken thread, enter the ground about five or six inches and form a little oblong cell, within which they change to the chrysalis state. In October or November (sometimes not until the following spring), the moths appear. The wingless females climb the trees or other objects where they meet the winged males, pair and soon deposit the eggs in clusters, usually upon the branches of the trees they have infested, completing the life history.

Remedies.

The life history of this species is so nearly like that of the canker-worm that the remedies suggested for that insect are applicable to this. It has never done as much damage as the canker worm, but it is capable of doing much injury to the foliage of apple trees.

THE APPLE LEAF BUCCULATRIX. *Bucculatrix Pomifoliella,* Clemmens.

This moth was described by Clemmens in 1860. It is known to be widely distributed, having been reported from Texas, Missouri, Massachusetts, New York, and now from several localities in Maine. It has done considerable damage to the foliage of apple trees especially in New York.

Description.

Eggs.—So far as we know, the eggs of this species have never been described. They must be quite small as the cocoons of this diminutive moth have been mistaken for insect eggs. They are said to be laid upon the leaves.

Larva.—About one-half inch long when mature, cylindrical, tapering at both ends. Joints of the body rounded and prominent, color dark yellowish, with a greenish tinge and reddish shades on the anterior segments. Body armed with short black hairs which are more numerous on the back of the first segment. Head small, brown and ellipsoidal. The larvæ are active and when disturbed suspend themselves by a silken thread.

Cocoons.—Dirty white, slender, about one-fourth inch long, ribbed longitudinally by about six prominent ridges, oblong, tapering at both ends, flattened on the side to which it is attached. Usually fastened to the twigs and branches in groups.

Chrysalis.—Dark brown, rough, punctured on the back, about one-tenth of an inch long. When ready to transform, the chrysalis works itself partly out of the cocoon and the moth comes forth.

Perfect Insect.—A small moth that has only about one-fourth inch expanse of wings. Fore wings whitish, tinged with pale yellow and dusty brown. On the middle of the inner margin is a conspicuous oval brown spot; a wide streak of the same color on the opposite margin extending nearly to the end of the wing, where it tapers and points to a small circular brown spot near the tip.

Life History.

This insect spends the winter in the pupa state in the cocoon, usually attached to the twigs and branches of the host plant. There is reason to believe that the larvæ, when full grown, sometimes desert the host plant and form their cocoons on other plants close by. We have seen cocoons on the side of a building in Maine. About the time the leaves unfold, the moths come forth and lay their eggs upon the tender foliage. The larvæ are full grown in July. The specimens sent us in July were in the larval form and went into the chrysalis state in August and emerged the following spring, a fact which would indicate only one brood in Maine. Prof. Riley believed that there are two or three broods in the latitude of St. Louis, Mo. In the latitude of New York, Prof. Lintner states that there are two broods, one in July and one in September.

In September or October the cocoons in which the pupæ spend the winter are formed. The larvæ feed externally upon the foliage, at least the leaves we have received had the upper epidermis and pulp eaten away in patches, the veins and lower epidermis intact.

Remedies.

(a) Jar the trees when the larvæ are full grown and they will suspend themselves by threads and can be swept down by a broom and killed by hot water or crushed.

(b) Apply kerosene emulsion with a spraying pump in winter, to the branches that bear the cocoons. The same application might be made for the first brood when the foliage is on.

(c) If in small numbers, the cocoons may be removed during the winter months by hand.

(d) Spray with Paris green, as for other leaf eating insects. This small moth is preyed upon by several parasites that attack the larvæ and hold the pest in check, and some of the cocoons probably suffer somewhat from inclemency of the weather. Possibly birds may eat them, but we find no record of observations.

THE WHITE-MARKED TUSSOCK MOTH. *Orgyia (Notolophus) leucostigma,* Sm. & Abb.

During the past ten years specimens of the above insect, in the egg, larval and wingless female stages of its life history, have been received at the Experiment Station from various parts of the State. It is a native species and is apparently widely distributed, having attracted considerable attention as an apple insect.

Description.

Eggs.—Three or four hundred in a mass, attached to the empty grayish cocoon previously occupied by the female moth. Egg mass convex, smooth, grayish-white; composed of several layers of eggs, with a frothy, gelatinous material between them.

Larva.—When mature, over one inch long; bright yellow; head, and two small protuberances on the back carrot-red; back ornamented with four cream-colored brush-like tufts; two long black plumes near the head and one near the posterior end of the body; sides clothed with yellow hairs; brown or black stripe on the back, and a dusky stripe on each side.

Cocoon.—Gray; spun on the inside of a leaf. Texture loose and the silk interwoven with numerous hairs from the caterpillar. Chrysalis, enclosed in the cocoon, oval, brown or sometimes whitish below, covered with whitish hairs or down.

Perfect Insect (female).—Wingless or wings mere rudiments; light gray, oblong-oval; body distended with eggs; legs long.

Perfect Insect (male).—Winged, expands an inch and a quarter; fore wings crossed by wavy bands of darker shade; a small black spot on the outer edge of the wing toward the tip; beyond it an oblique blackish stripe, near the outer hind angle a minute white crescent; body gray, with a small black tuft near the band of the abdomen; antennæ feathered.

Life History.

During the winter months there will occasionally be found in the orchard, dead leaves attached to the branches of the trees. Upon examination these will usually be found to contain an empty, gray cocoon with a mass of eggs attached to it, as described above. These eggs hatch, in Maine, about the first of June, or earlier farther south. The young larvæ at once begin to devour the leaves of the tree. When disturbed they lower themselves by means of a silken thread which they climb when danger is past. The beautiful caterpillars described above feed about two months and then spin their cocoons. The moths soon emerge and the wingless females, being little more than animated masses of eggs are sluggish. The males, having wings, are able to fly, and they meet the females while resting upon the empty cocoon to which the mass of eggs is finally attached. If there is only one brood, the eggs do not hatch until the following spring; if two broods, the eggs soon hatch, producing the second brood of caterpillars which complete their growth late in the season and enter the chrysalis state. The moths soon emerge, mate, and the female lays the eggs on the cocoon, completing the life history.

Remedies.

Collect and destroy the eggs and cocoons during the winter. Spray with Paris green, or with Paris green and Bordeaux mixture. Usually no special treatment is required for this insect if the trees are thoroughly protected from the tent caterpillar.

THE FALL CANKER WORM. *Anisopteryx pometaria,* Harris.

This insect has been very bad at times in Maine, doing much damage to fruit and shade trees. Parasites and other enemies soon control it, however, so that it does not usually do damage in the same locality more than two successive seasons.

Description.

Eggs.—Grayish, flattened above, with a central puncture and a brown circle near the border. Each female lays 100 or 200 eggs in rows arranged in clusters on the twigs or branches, or on fences and buildings, usually in exposed situations.

Larva.—Pale olive green when young, but varying in color, when grown, from greenish yellow to dark brown. Dorsal band broad, brownish; lateral lines three, white, the middle one paler; broad brown bands below the lateral lines, and below that a broad white band. Under side, flesh-colored; head brown.

These caterpillars belong to the group of inch or measuring worms, because they alternately loop and extend the body in moving. When at rest they sometimes assume an erect position, and can hardly be told from twigs. When full grown they are about one inch long. When mature they crawl down the trunk or let themselves to the ground by a silken thread, and burrow to a depth of from two to six inches. They make a tough cocoon of buff colored silk interwoven with earth, and in twenty-four hours turn into the chrysalis.

Chrysalis.—Light greyish brown; about half an inch long. The male slender, and provided with wing cases; the female larger, and without wing cases.

Perfect Insect (male).—A moth provided with wings, the fore wings brownish gray, glossy, crossed by two whitish irregular bands, the outer one enlarging into a pale spot at the apex. Hind wings grayish brown with a white band crossing them, and in the center a faint blackish dot.

Perfect Insect (female).—Wingless; uniform shining ash color above, gray beneath; length three to four-tenths of an inch. Sluggish of movement and spider-like in appearance.

Life History.

The eggs hatch about the time the buds on the apple trees expand. The young worms feed upon the tender leaves, seeking shelter within the expanding flowers or buds when the weather is wet and cold. They eat holes in the leaves while young, but when older devour the whole pulp of the leaf, leaving only the veins and midrib. They feed for about four weeks, and when numerous so injure the foliage as to give the trees the appearance of having been scorched with fire. They have done great damage to the foliage of trees along highways. While letting themselves down to the ground they are often swept off by carriages and carried long distances.

The larvæ enter the ground, spin cocoons and are changed immediately into the chrysalis state, from which, during the fall, winter and following spring, they emerge in the perfect form, completing the life history.

Remedies.

Since the females are wingless, they may be trapped and destroyed by placing bands of tarred paper about the trunks of the trees and smearing these with printer's ink, tar mixed with oil, or refuse molasses. As these materials soon dry, however, they must be frequently renewed, or the insects will be able to cross. Tin or lead troughs, containing crude petroleum, are also used with some success. The most effective treatment, however, is to spray with Paris green, just as soon as the insects appear. Delay in applying the poison is often fatal to success.

There are numerous natural enemies, including a small mite, which destroys the eggs; a species of Microgaster,—a small four-winged fly,—parasitic upon the larvæ; and a species of tachina fly, also parasitic upon the larvæ.

THE APPLE TREE APHIS. *Aphis mali*, Fabr.

This insect was originally from Europe, but is now a pest in apple orchards throughout the northern United States and Canada, often causing serious losses in young orchards and nurseries.

Description.

Eggs.—Minute, oval, light yellow or greenish when first laid, gradually changing to shining black.

Young Insects (male).—Head, thorax and antennæ black; neck usually green; abdomen short, thick, oval, bright green; sides with row of black spots; nectaries and tail-like appendages black; wings transparent with dark brown veins.

Perfect Insect (female).—Length of wingless form less than one-tenth inch; body oval, pale yellowish green, often striped with deeper green; eyes and tail appendages black; honey tubes green. The winged female resembles the male in color.

Life History.

The eggs are deposited in the autumn in the cracks of the bark of twigs and at the bases of the buds. The eggs hatch when the buds begin to expand and the lice locate themselves on the young buds and leaves by means of their beaks and feed upon the juices. The spring brood is composed of females and is about ten days reaching maturity. Each louse gives birth to living young, producing about two a day for two or three weeks, and then dies. These young become mothers in about ten days. This process is continued through the season, there being many generations, mostly wingless females, without the appearance of males. Winged females are sometimes produced which, migrating to other trees, spread the pest. Late in the season males and females are produced in the same brood and, after mating, eggs are laid to perpetuate the species, thus completing the life history.

Remedies.

Wash the trees during winter or early spring with a strong solution of soft soap, or of washing powder, to destroy the eggs. Later in the season, if the aphids become numerous, spray with kerosene emulsion or with a strong decoction of tobacco, made by pouring 1 gallon of boiling water over a pound of tobacco stems or leaves.

There are many natural enemies of the aphis which should be encouraged. Among these are seven or eight species of lady-birds, and the larvæ of syrphus flies and of chrysopa or lace winged flies.

THE RED-HUMPED APPLE TREE CATERPILLAR. *Œdemasia concinna,* S. & A.

This species is native to the United States and has been reported from several localities in Maine as doing considerable damage to the foliage of apple trees. It is said to be widely distributed in this country, but is not an abundant species. It prefers the apple, but is known to feed upon the plum, cherry, rose, thorn, and pear,—plants belonging to the rose family.

Description.

Eggs.—The eggs, so far as we know, have not been described.

Larva.—When full grown, the larvæ are often an inch and a quarter long. They may be known by the coral-red head and a hump of the same color on the fourth ring or segment from the head. The body is striped lengthwise with narrow yellow, white and black lines. There are two rows of black spines along the back, and rows of shorter black spines on the sides. Each spine bears a fine hair. The spines on the coral red hump are more prominent than the others. The hinder end of the caterpillar tapers and is usually elevated when the insect is at rest. When handled, a fluid with a strong acid smell is emitted. This is so offensive that the insects are never eaten by birds.

Perfect Insect.—A moth which measures from an inch to an inch and a quarter across the wings. The fore wings are dark brown on the inner, and grayish on the outer margin. There are several longitudinal streaks along the margin, also a dot near the middle and a spot near the angle, all dark brown. The body is light brown, and the thorax of a darker shade.

Life History.

The moths are on the wing late in June or in July. The female deposits her eggs on the under side of a leaf, in a cluster, usually during July. They soon hatch into small caterpillars. These caterpillars, while young, feed upon the tender tissues of the under side of the leaf, leaving the upper surface unbroken, but when large they devour greedily the whole leaf, excepting the midrib. They reach maturity during August and September. There is but one brood in the northern states. In the broods further south, the caterpillars feed in bunches and when not feeding remain close together. When mature they descend to the ground and hide under leaves or rubbish, or sometimes burrow a little into the ground and slowly change to the chrysalis state, where they remain until the following spring, when the moths appear, completing the life history.

Remedies.

As these caterpillars go in flocks, and when not feeding remain close together, they may easily be destroyed by cutting off the branch on which they appear and burning it. They may also be destroyed by jarring the limb, and, when they fall to the ground, trampling them under foot. Spraying with Paris green is also effective, but poison should be used with caution on bearing trees. It is said that ichmeumons are parasitic upon them and hold them in check.

THE CECROPIA EMPEROR MOTH. *Platysamia cecropia,* Linn.

This is a native species and the largest moth found in the United States. It is widely spread and a general feeder. It is a well known apple insect, and, though not abundant, attracts attention on account of its large size and voracious appetite. It has been reported in its various stages from every part of Maine.

Description.

Eggs.—Nearly one-tenth of an inch long, almost round, dull creamy white, with a reddish streak near the middle.

Larva.—When first hatched, black with shining black knobs on the body from which arise black hairs. It molts several times in coming to maturity. When full grown it is from three to four inches long and pale green. There are coral red warts on the third and fourth segments, yellow warts on the back of the other segments, except those on the second and terminal, which are blue like the smaller tubercles on the side.

Cocoons.—About three inches long, pod-shaped, rusty grey or brown and firmly attached to one side of a twig. Composed of two layers of silk, an outer loose, papery, fibrous one and a densely woven inner one which contains the brown chrysalis.

Perfect Insect.—A moth with from five to seven inches spread of wing. Both the front and hind legs are rich brown. About the middle of each wing is a kidney-shaped white spot shaded with red and margined with black. Near the tips of the fore wings is an eye-like spot containing a bluish white crescent.

Life History.

The moth lays from two to three hundred eggs, usually in pairs, firmly fastened to the under side of the leaves of the host plant. The eggs hatch in a week to ten days, the young larvæ first feeding on the empty egg-shells. They have a ravenous appetite, grow rapidly, and consume a large amount of food. When nearly mature, a few on a young apple tree may in short time strip it of leaves. The larvæ, when full grown in the fall, spin their cocoons, attaching them to the twigs of shrubs or trees on which they feed. Their great size makes them conspicuous objects after the leaves fall. The following spring, in May or

June, the moths appear and soon mate, completing the life history.

Remedies.

The larvæ and cocoons are not abundant, and are so conspicuous that hand picking is the most satisfactory treatment.

C. INSECTS AFFECTING THE FRUIT.

THE CODLING MOTH. *Carpocapsa pomonella,* Linn.

The codling moth is probably native to southeastern Europe, the native home of the apple. It was introduced into the United States probably in apples or pears, early in the history of the country, but it was not noticed until 1849, its work previously having been referred to the plum curculio.

It is found in most of the apple growing countries of the world and is widely distributed in Maine, being one of the worst apple insects. The larvæ, particularly of the second brood, are often in apples when marketed, and crawl out and go into the pupa stage when the apples are stored or exposed for sale. It is not uncommon to see the moths in the spring in apple outhouse cellars, or on the windows of stores and houses.

While the codling moth is more particularly an apple insect, it feeds also upon pears, wild haws, crab apples and quinces, of the pome fruits, and upon plums, apricots and cherries of the stone fruits. Specimens have been reared from the fruit of a species of screw bean and from the seed buds of roses.

Description.

Egg.—A thin scale, slightly smaller than the head of a pin; whitish, often with a yellowish tinge, semi-transparent, looking like a minute drop of milk on the skin of the fruit.

Larva.—Whitish, flesh-colored or pink; one-sixteenth of an inch long when hatched; three-fourths of an inch long when full grown; three pairs of true legs and five pairs of false legs; head, first thoracic and anal segments brown; body armed with a few short hairs arising from more or less distinct black spots.

Cocoon and pupa.—When mature the larva spins, in a day, a thin tough silken cocoon, the inner layer thin and white, the outer layer mixed with pieces of the bark or substance on which the cocoon rests. Within the cocoon, or later, the larva changes to the brown pupa.

Moth.—Spread of wing about three-fourths of an inch. Front wing crossed by numerous gray and brown lines, which are often wavy, the hind angle marked by a large, dark brown spot streaked with bronze or gold. The hind wing light greyish-brown with a darker margin. The males have a pencil of long black hairs in a furrow on the upper surface of the hind wing, and on the under side of the front wing an elongate, narrow, black spot.

Life History.

The eggs are laid on the surface of the fruit, on its stem, or on the adjacent leaves. Between the middle of May and the middle of June, a week or two after the blossoms have fallen and the fruit is from a half-inch to an inch in diameter, the young larvæ craw about on the surface of the fruit. The most of them find their way into the blossom end, where they remain feeding for several days, and finally bore to the core of the fruit. They are full grown in about three weeks, when they make their exit channel to the surface. After feeding a few days near the surface, they emerge and usually spin cocoons under the loose bark of the trunk of the tree. Those designed for the first brood change soon to the pupa and the moths emerge in about two weeks, to lay eggs for the second brood. Those that go into the cocoon in August, and later, remain in the larval state in the cocoon during the winter and emerge as moths the following spring. In Maine only part of the first brood transform to moths the same season. When the moths appear, whether the same season or the following spring, the life history is complete.

Remedies.

As soon as the blossoms fall, spray the trees with Paris green, or with Paris green and Bordeaux mixture. The fallen fruit should be gathered and destroyed. Hogs or sheep may be kept in the orchard for the purpose. Owing to the protection afforded by the apple, the larvæ are particularly free from natural enemies. There are, however, two species of ichneumon flies which are occasionally found as parasites.

THE PLUM CURCULIO. *Conotrachelus nenuphar,* Herbst.

The plum curculio is a native of this country and originally fed upon the wild plums, which it still infests. Both males and females puncture the fruit to feed on it, but only the latter make the crescent-shaped cuts. This insect is known to infest the plum, peach, nectarine, apricot, cherry, apple and pear. From ten to twenty-five per cent of the early apples examined in July, showed the characteristic cut.

After the first of August but few cuts, made by this insect, were found and we are led to believe that they prefer the earlier varieties, and that the apples punctured do not mature. A large per cent of the larvæ which hatched did not reach maturity. We, however, succeeded in transforming enough to identify the species. It would seem that the plum curculio does not flourish well in the apple and attacks it in the absence of its favorite fruit. The decline in the cultivation of plums, due to the ravages of this pest, and the black knot, will account for its attacking apples.

Description.

Egg.—Oblong, oval, pearly white. Visible to the naked eye, and can be found readily by examining the crescent-shaped cut made by the female.

Larva.—When young, tiny, soft, footless; head distinct, horny. When full grown it is usually of a glossy yellowish white, but varies in color with the food; head light brown or yellowish. Along each side is a light line, below which is a row of black bristles and above it a less distinct one, and toward the hind extremity a few pale hairs; length about two-fifths of an inch. The larva is so transparent, the internal organs are plainly seen through the skin, imparting a reddish color to the central parts of the body.

Perfect Insect.—A beetle, belonging to the family of insects known as weevils or snout beetles. It is blackish or greyish, rough, with a black shining hump on each wing case near the middle, behind which is a dull ochre-yellow band marked with whitish about the middle; each thigh has two small teeth on the under side; snout short. Length of insect about one-fifth of an inch.

Life History.

The beetles hibernate in secluded spots during the winter and appear on the wing about the time the plum trees blossom. As soon as the young fruit forms, the eggs are deposited. The female, when about to lay an egg, makes a minute incision with her jaws and then, inserting the snout, enlarges the hole sufficiently to hold the egg, turns around, deposits the egg, thrusts it to the bottom of the hole with the snout, then cuts a crescent-shaped incision around one side of the opening.

Only one egg is laid in a place, though on the apple, several punctures may occur on the same fruit. Each beetle lays from fifty to one hundred eggs and deposits from five to ten a day. The time of depositing eggs by early and late beetles probably occupies about two months. The first apples examined, July first, were badly punctured and no new cuts were found after the twentieth of the month. The eggs hatch in a few days and the larva is full grown in from three to five weeks. The infested apples or plums usually drop to the ground before the larva is grown and when mature it leaves the fruit, enters the ground four to six inches, forms an oval cavity, changes to the chrysalis, and in from three to six weeks the perfect insect is formed and makes its way to the surface, completing the life history. There seems to be some reason for believing that a few remain in the ground all winter. The specimens we transformed appeared in September, about four weeks from the time the larva was mature. We are inclined to believe that those apples in which the egg hatches and the larva grows, drop early. Abortive cuts shrivel and deface the fruit and check its growth, but it may mature.

Remedies.

Spraying with Paris green early in the season and after the blossoms fall is sometimes practiced. On a few trees in the garden, the jarring method employed for plum trees may sometimes be used to advantage. There are many insects which devour the curculio larva as it escapes from the fruit. Foremost among these are two or three species of common ground beetles. The larva of the soldier beetle is also a useful destroying agent, often entering the fruit while still on the tree, in search of its prey.

THE APPLE MAGGOT. *Trypeta (Rhagoletis) pomonella,* Walsh.

This is a native species which originally fed upon thorn plums, and probably wild crab apples, and has transferred its depredations to cultivated apples. It first attracted attention nearly fifty years ago, and as early as 1867 was doing great damage in New York, Massachusetts, Connecticut and Vermont. Since that time it has spread and increased until it is now widely distributed and regarded as one of the worst pests of the apple.

It is particularly bad in Maine, attacking nearly all varieties of apples, both fall and winter, though most destructive to the early sweet varieties. It is known as the railroad worm in Maine.

Description.

Eggs.—Length .032 to .036 inch; breadth .008 to .009 inch; light yellow when taken from the fruit; fusiform and about four times as long as wide; pedicellate at the end. The larva is placed in the egg with the head away from the pedicel and the end containing the head is inserted into the apple.

Larva.—Length .28 to .32 inch; breadth .07 to .08 inch. When full grown usually yellowish white. When younger, and sometimes when full grown, tinged with greenish; footless; the body composed of fourteen segments. Ninth, tenth and eleventh segments widest, narrowing rapidly toward the head, which is small, pointed and emarginate. From the broadest segment the body slopes slowly backward to the last segment, which maintains its size one-third of its length and then abruptly slopes to one-half its thickness. The lower and posterior half is nearly vertical behind, giving the larva a docked appearance.

Pupa.—Length .17 to .21 inch; breadth .08 to .1 inch; pale yellowish brown. When the maggot assumes the pupa state it does not shed the larval skin, but contracts, assuming an oval form. The pupa is a little more than twice as long as wide, and barrel-shaped. The ends slope about equally, and the head end is very pointed. Otherwise the resemblance between the pupa and larva is apparent. There is quite a variation in the size of pupæ. Some are much longer and thicker than others and may be of females, as the female flies are much larger than the males.

Perfect Insect.—A two-winged fly somewhat smaller than the house fly. Readily recognized by its general black color; yellowish head and legs; dark feet; greenish prominent eyes; white spot on the back and upper part of the thorax; three white bands across the abdomen of the male, four on the female, and four black bands across the wings, resembling the outlines of a turkey.

Life History.

In early seasons, under favorable conditions, the flies in Maine begin to emerge about July first, and earlier in the states farther south. They continue to emerge all summer and are on the wing in abundance until the middle or last of September, and occasionally in October. Early frosts check them. The flies lived three weeks in confinement and will probably live longer in nature. They begin to deposit their eggs in the early fruit by July first, or earlier, and egg laying continues while the flies are on the wing. The earlier races of flies affect the earlier varieties, and the later races, the fall and winter fruit. Each female is capable of laying between three and four hundred eggs, and possibly more, which are inserted from time to time, one in a place, by means of a sharp ovipositor through the skin of the apple. The eggs being successively developed in the ovary of the female, after the manner of the eggs of the barnyard fowl, the season of egg laying extends over considerable time. The eggs are vertically inserted into the pulp of the apple, with the end opposite the pedicel, which contains the head of the maggot, pointing toward the core. The eggs are deposited in all parts of the apple, usually upon the cheeks, sparingly near the calyx and stem ends, and more abundantly upon the pale or shaded side of the fruit. The time required to deposit the eggs is about one-half minute. By means of the sharp ovipositor a characteristic puncture is made through the skin of the apple. These punctures can be detected by careful observation with the naked eye, but a pocket lens is necessary to see them well. They appear as brownish specks, and have not been before distinguished from the brownish, rusty spots common on apples. Under the glass they appear as circular or oblong openings, surrounded by a brownish border, somewhat shrunken by the shriveling of the tissue beneath. They may be numerous on the same apple.

The eggs hatch in four or five days, under favorable conditions, and the minute larvæ begin at once to work in the pulp of the apple. They have no true opposable jaws, but the head is provided with two black curved hooks, situated above the mouth, with which they rasp the pulp of the fruit rapidly by means of a vertical movement of the head. They live upon the juice of the particles of apple thus detached, which is sucked into the mouth. The pulp is rejected and turns brown. They can burrow their length in soft fruit in less than a minute. The channels made by the young larvæ, while the fruit is still growing, are largely healed and neither they nor the minute white larvæ are likely to be detected by the naked eye, or by the casual observer. As the larvæ grow, and the fruit matures, the enlarged channels do not heal, but turn brown and the presence of the maggots is then readily detected. These channels meander through the whole fruit, even the core. They often cross each other, enlarge as the larvæ grow, and in the last stages of Trypeta work, run together, producing large cavities. Finally they involve the whole fruit, rendering it a worthless mass of disgusting corruption, held together by the skin.

In the early stages of Trypeta work there is no external evidence that the fruit is infested, excepting the punctures made for the insertion of the eggs. In advanced Trypeta work, brownish trails, where the larvæ have come to the surface, can be seen through the skin. Apples marketed with no suspicion of their being infested are frequently found hopelessly involved, honeycombed and worthless. Apples apparently sound when gathered may, by the presence of eggs or young larvæ, afterwards become worthless. The newly hatched larvæ are a little shorter than the egg and can not readily be detected in the white pulp of the apple without a pocket lens. They attain their growth, under favorable circumstances, in four or five weeks, but their development may be arrested by cold, by insufficient food, hardness of the fruit, etc., for a great length of time. They ordinarily remain in the fruit but a short time after they mature, and often leave it and go into the pupa state while there is still an abundance of nourishment and the fruit is still occupied by younger larvæ of various ages. If the fruit is kept cold, the larvæ, though full grown, remain longer, or may even change to the pupa state, within it. We have never seen the exit holes in hanging fruit and believe the maggots do not drop, but go into the ground from the fallen fruit. Their presence causes the fruit to mature earlier. Fruit picked from the trees may contain larvæ, and often stored or marketed fruit is alive with maggots.

The exit openings are characteristic, irregular holes, about one-twelfth inch in diameter, surrounded by a brownish border. They look as though the maggots had gnawed a hole for the head, and then forced the body through, leaving a lacerated border. They may occur anywhere on the apple but are more frequently found where the brown larval trails show through the skin. They begin to appear in the early apples about the first of August and may be found until frost, in windfalls, and in the stored fruit as long as the larvæ remain.

It would seem that the development of the larvæ is so nicely timed that they are not mature until the fruit is ripe. Their development is slower in late and in hard fruits. A dozen maggots may infest the same apple, though a single one is enough to render it worthless. The maggots have been found in numerous varieties, early and late; sweet, acid, and sub-acid, extending from early in July through August, September, October, November, December, January and February. The larvæ usually leave the apples and go into the ground an inch or less and soon change to the pupa state. The pupæ are occasionally found within the fruit in windfalls and quite frequently in stored fruit. Sometimes the larvæ change on the surface of the ground, under decaying fruit. On grass ground they probably change in the debris about grass roots.

Remedies.

The Trypeta is an unusually hard insect to destroy, since the eggs are laid under the skin of apples; the larvæ spend their time within the fruit; the pupæ are safely concealed in the ground, within the shrunken skins of the larvæ; thus in all forms it is immune from the attacks of parasites. The flies do not seem to be attracted by sweetened poisonous substances and cannot be trapped. The eggs are so safely lodged underneath the skin of the apple as to be beyond the reach of poison applied by spraying, hence there is no hope in that direction. The only chance left is to destroy the larvæ and pupæ. This can best be done by destroying the fruit within which they are contained. The larvæ are found abundantly in windfalls and in decayed fruit from the cellars, and the pupæ in bins and barrels where fruit has been stored. Destroying the windfalls, and all refuse fruit, and burning the rubbish from places where fruit is stored are, then, the only reasonable and practicable methods of treatment now recognized.

DESCRIPTION OF PLATES.

PLATE I. Beneficial Insects. See p. 107.

Fig 1.—*Pimpla inquisitor,* an ichneumon parasite of the tussock moth caterpillar. *a,* parasitized caterpillar; *b,* egg of parasite; *c,* same in situ; *d,* parasite larvæ issuing; *e,* parasite cocoons—all slightly enlarged, except *b* and *c,* which are much enlarged. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

Figs. 2 and 3.—Ichneumons, parasitic upon apple tree tent caterpillar.

Fig. 4.—Ichneumon parasitic upon flat-headed apple tree borer.

Fig. 5.—The 15-spotted lady bird, destructive to plant lice. *a,* larva; *b,* chrysalis; *d, e, f, g,* various forms of the perfect insect.

Fig. 6.—The twice-stabbed lady bird, destructive to the oyster-shell bark louse.

Fig. 7.—Tachina fly, parasitic on apple tree tent caterpillar.

PLATE II.

Fig. 1.—Round-headed borer (*Saperda candida*). See page 108. *a,* larva; *b,* pupa; *c,* beetle.

Fig. 2.—Flat-headed borer (*Chrysobothris femorata*). See page 109. *a,* larva; *b,* pupa; *c,* head of larva, under side; *d,* beetle.

Fig. 3.—Woolly louse. (*Schizoneura lanigera*). See page 113. *a,* excrescence upon the root; *b,* the lice at work; *c,* a louse much magnified.

Fig. 4—Pear-blight beetle or shot-borer (*Xyleborus pyri*). See page 112.

Fig. 5.—Work of the pear-blight beetle.

(Figs 4 and 5 after Howard).

PLATE III.

Fig. 1.—Oyster-shell bark louse (*Mytilaspis pomorum*). See page 110. *a,* egg; *b,* female louse; *c, d, e, f,* stages in the life history; *g,* under side of female scale,—all much magnified.

Fig. 2.—Oyster-shell bark louse. Scales in place upon the bark.

Fig. 3.—Lesser apple leaf folder, (*Teras minuta*). See page 117. *a,* larva; *b,* pupa; *c,* moth; *d,* case made on apple leaf. (After Smith).

Figs 4 and 5.—Oblique-banded leaf roller (*Cacœcia rosana*). See page 116.

Fig. 6.—Bud moth (*Tmetocera ocellana*). See page 114. (Cornell Expt. Sta., Bulletin 50).

PLATE IV.

Fig. 1.—Forest tent caterpillar (*Clisiocampa disstria*). See page 118. *a,* egg clusters; *b,* moth; *c* and *d,* eggs; *e,* caterpillar.

Fig. 2.—Apple tree tent caterpillar (*Clisiocampa Americana*). See page 120. *a* and *b,* larvæ; *c,* egg cluster; *d,* pupa; *e,* male moth; *f,* female moth.

PLATE V.

Fig. 1.—Fall web worm (*Hyphantria cunea*). See page 121. Moths and cocoons—natural size. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

Fig. 2.—Fall web worm. *a,* light form of full-grown larva; *b,* dark form of same; *c,* pupa; *d,* spotted form of moth (compare fig. 1), all slightly enlarged. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

PLATE VI.

Fig. 1.—Lime tree winter moth (*Hybernia tillaria*). See page 123. *a,* larvæ at work; *b,* female moth; *c,* male moth.

Fig. 2.—Apple leaf bucculatrix (*Bucculatrix Pomifoliella*). See page 125. *a,* cocoons, natural size; *b,* same, enlarged; *c,* moth, enlarged.

Fig. 3.—Apple tree aphis (*Aphis mali*). See page 129. *a,* female; *b,* male; *c,* male, natural size.

Fig. 4.—Fall canker worm (*Anisopteryx pometaria*). See page 128. *a,* male moth; *b,* female moth; *d,* egg cluster.

Fig. 5.—Fall canker worm,—eggs and larva. *a* and *b,* egg, enlarged; *c,* segment of larva enlarged; *e,* egg cluster; *f,* full grown larva.

PLATE VII.

Fig. 1.—White-marked tussock moth (*Orgyia leucostigma*). See page 126. *a,* larva; *b,* female pupa; *c,* male pupa; *d, e,* male moth; *f,* female moth; *g,* same, ovipositing; *h,* egg mass; *i,* male cocoons; *k,* female cocoons, with moths carrying eggs—all slightly enlarged. (After Howard. Farmer's Bulletin 99, U. S. Dept. Agr.)

Fig. 2.—Codling moth (*Carpocapsa pomonella*). See page 133. *a,* fruit showing work of larva; *b,* point of entrance; *c,* larva, full grown; *d,* pupa; *f, g,* moth; *h,* head of larva; *i,* cocoon. (After Riley).

Fig. 3.—Plum curculio (*Conotrachelus nenuphar*). See page 134. *a,* larva; *b,* chrysalis; *c,* beetle; *d,* beetle and its work—all except *d,* enlarged.

PLATE VIII.

Fig. 1.—Apple maggot (*Trypeta pomonella*). See page 136. Mature fly (female), much enlarged.

Fig. 2.—Apple maggot. Larva much enlarged.—The short line above shows the natural size.

Fig. 3.—Apple maggot. An infested fruit.

INDEX TO BULLETIN 56.

PAGE

Anisopteryx pometaria 128
Aphis, apple tree 129
Aphis mali 129
Apple maggot 136
Apple tree tent caterpillar.................................. 120
Bark louse, oyster-shell 110
Beneficial insects 107
Borer, flat-headed 109
Borer, round-headed 108
Bucculatrix, apple leaf 125
Bucculatrix Pomifoliella 125
Bud moth 114
Cacœcia rosana 116
Canker worm, fall 128
Carpocapsa pomonella 133
Cecropia emperor moth 132
Chrysobothris femorata 109
Clisiocampa Americana 120
Clisiocampa disstria 118
Codling moth 133
Conotrachelus nenuphar 134
Curculio, plum 134
Emperor moth 132
Fall canker worm 128
Fall web worm 121
Flat-headed borer 109
Forest tent caterpillar 118
Hyphantria cunea 121
Hybernia tillaria 123
Ichneumon flies 107
Insects affecting foliage 114
Insects affecting fruit 133
Insects affecting trunk and branches.................................. 108
Lady birds 107
Leaf folder, lesser 117
Leaf roller, oblique-banded 116
Lesser apple leaf folder 117

PAGE
Lime tree winter moth 123
Mytilaspis pomorum 110
Oblique-banded leaf roller 116
Œdemasia concinna 130
Orgyia cucostigma 126
Oyster-shell bark louse 110
Pear-blight beetle 112
Platysamia cecropia 132
Plum curculio 134
Railroad worm 136
Red-humped apple tree caterpillar 130
Round-headed borer 108
Saperda candida 108
Schizoneura lanigera 113
Shot-borer 112
Syrphus flies 107
Tachina flies 107
Tent caterpillar, apple tree 120
Tent caterpillar, forest 118
Teras minuta 117
Tmetocera ocellana 114
Trypeta pomonella 136
Tussock moth, white-marked 126
Web worm, fall 121
White-marked tussock moth 126
Woolly louse 113
Xyleborus pyri 112

PLATE I.

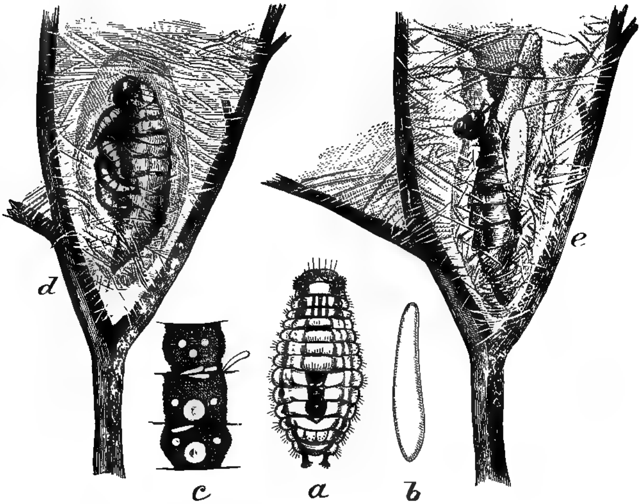


FIG. 1.

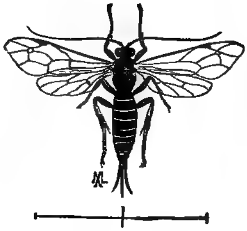


FIG. 2.

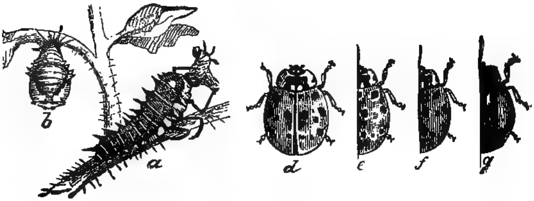


FIG. 5.

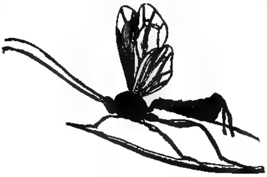


FIG. 3.

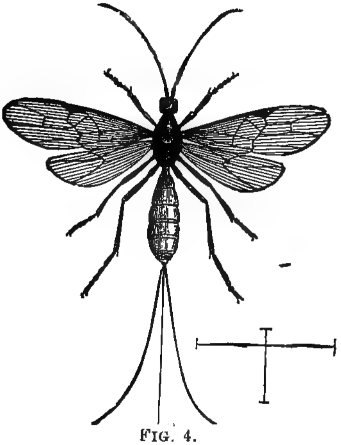


FIG. 4.

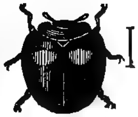


FIG. 6.

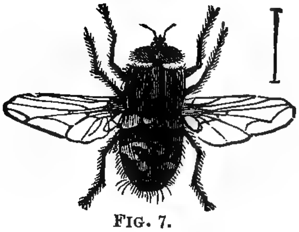


FIG. 7.

PLATE II.

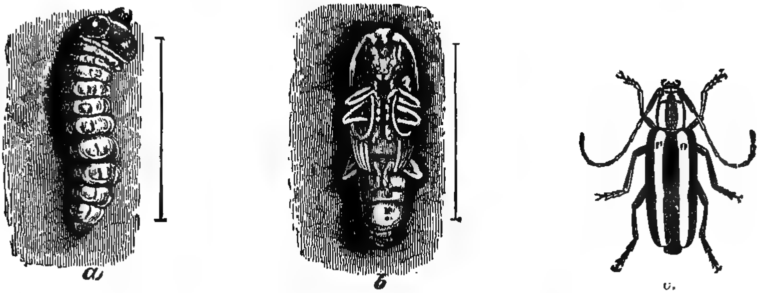


FIG. 1.

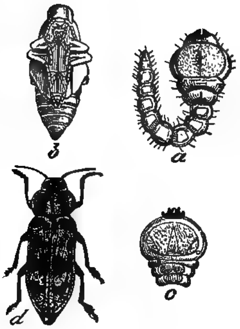


FIG. 2.

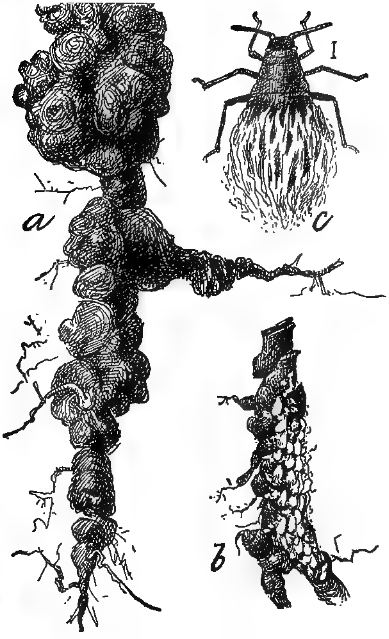


FIG. 3.

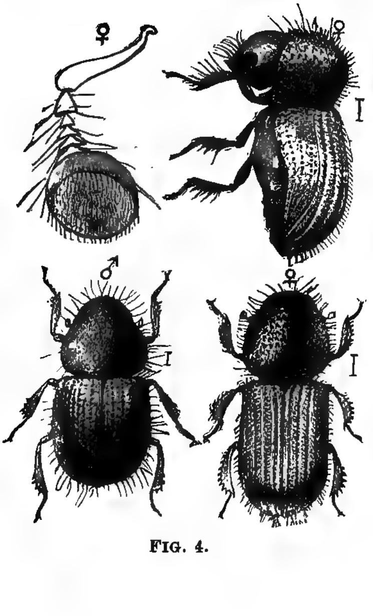


FIG. 4.

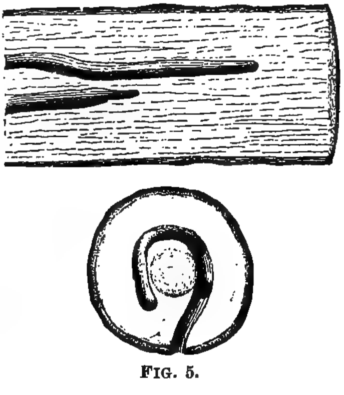


FIG. 5.

PLATE III.

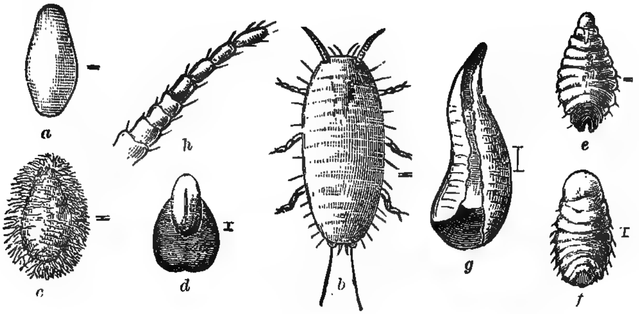


FIG. 1.

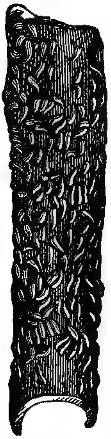


FIG. 2.

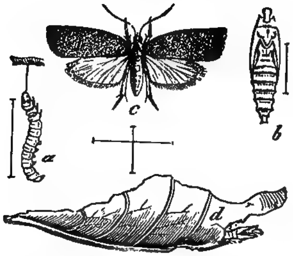


FIG. 3.

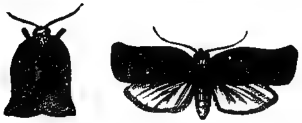


FIG. 4.

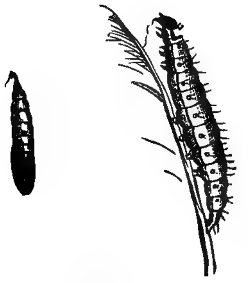


FIG. 5.

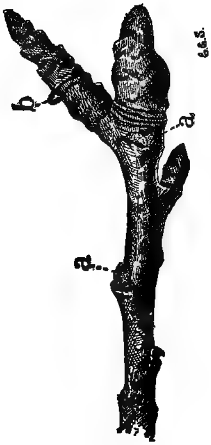


FIG. 6.

PLATE IV.

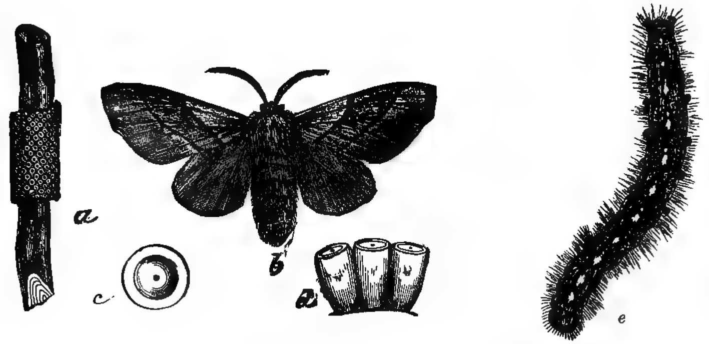


FIG. 1.

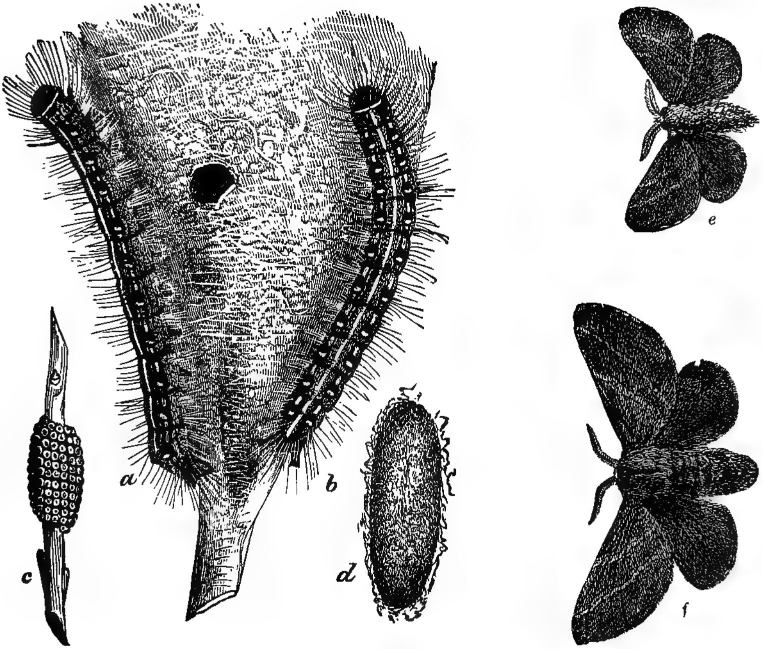


FIG. 2.

PLATE V.

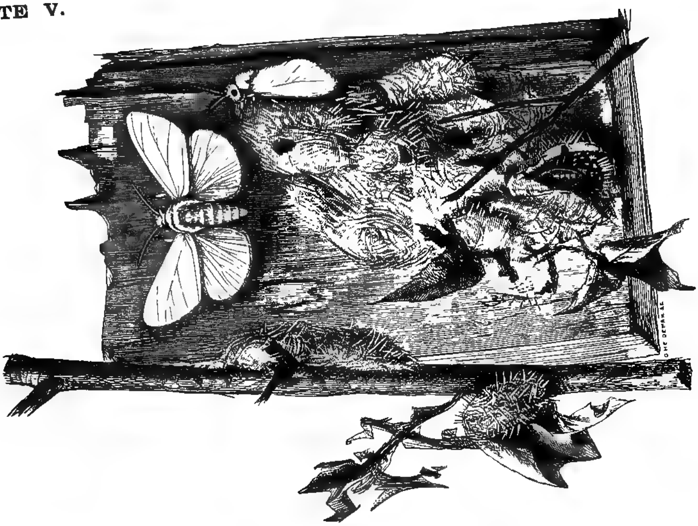


FIG. 1.

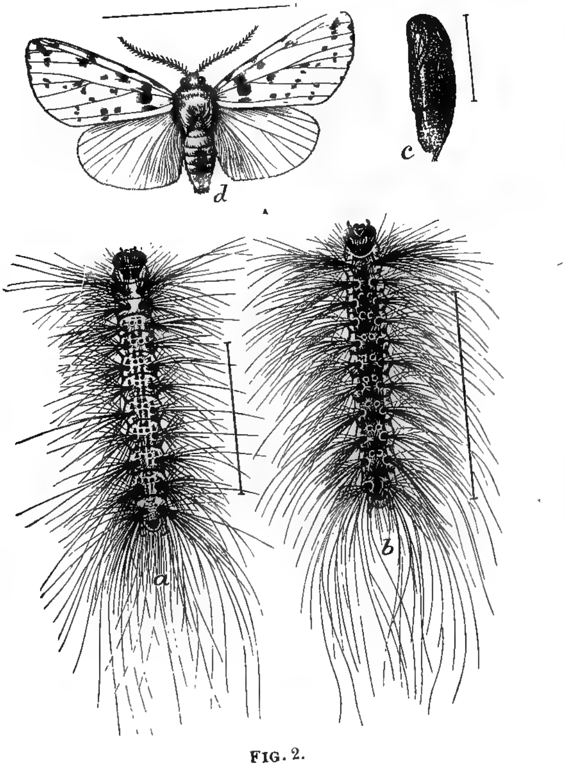


FIG. 2.

PLATE VI.

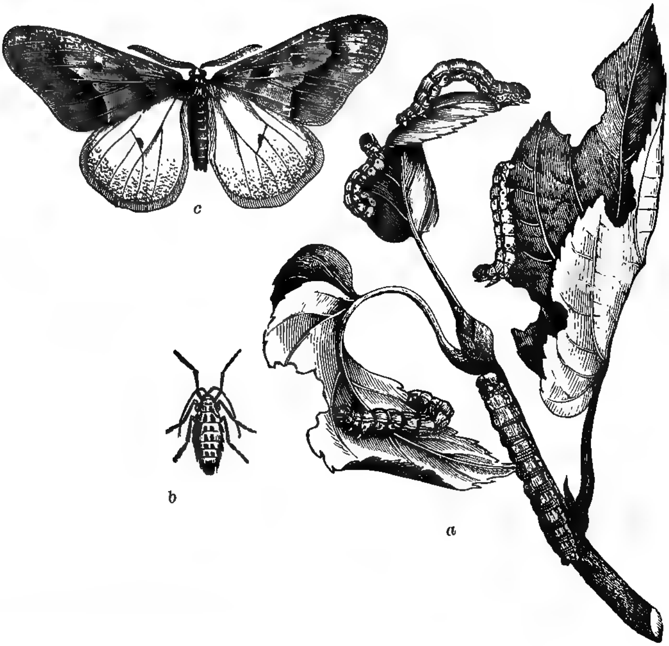


FIG. 1.

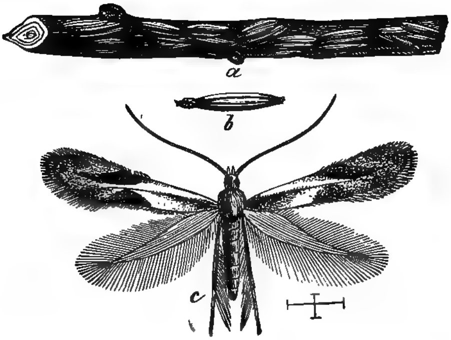


FIG. 2.

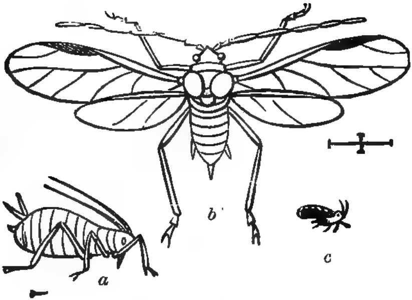


FIG. 3.

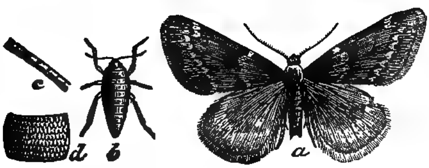


FIG. 4.

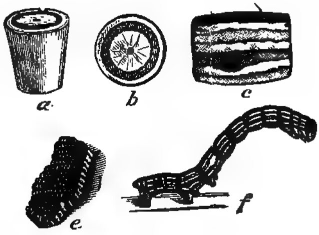


FIG. 5.

PLATE VII.

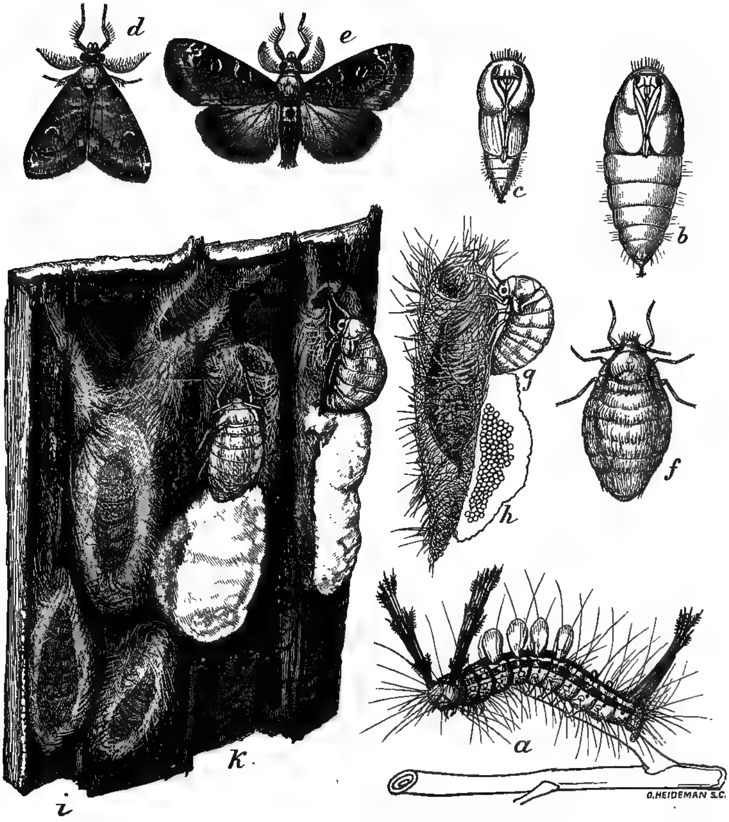


FIG. 1.

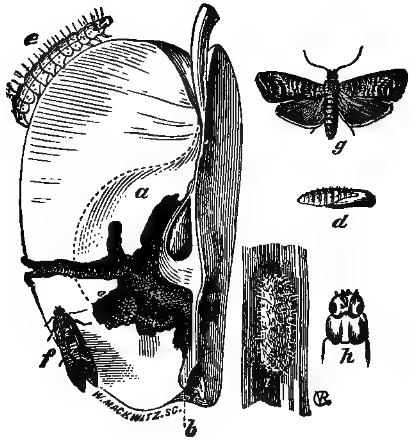


FIG. 2.

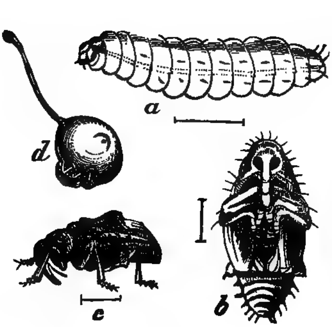


FIG. 3.

PLATE VIII.

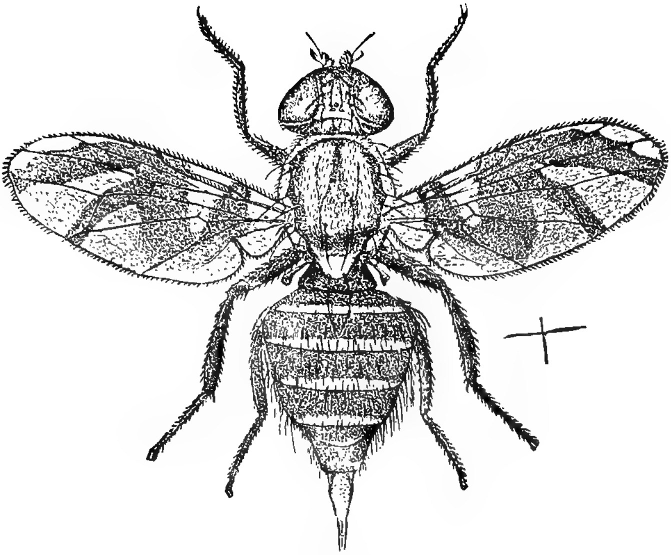


FIG. 1.

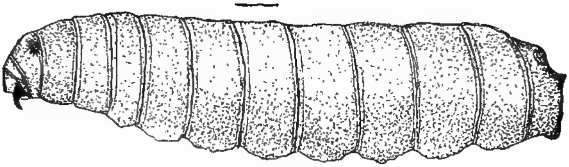


FIG. 2.

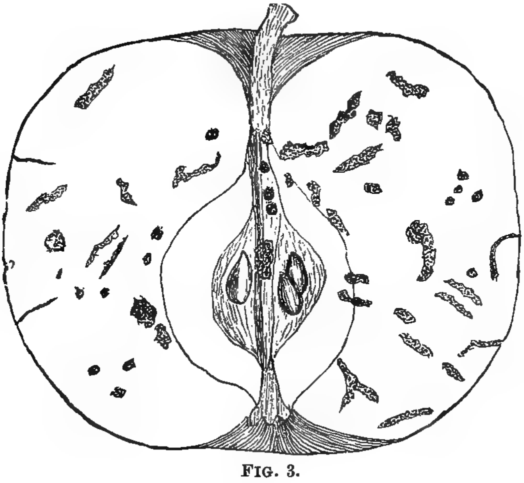


FIG. 3.

EXPERIMENTS WITH POTATOES.

CHAS. D. WOODS AND J. M. BARTLETT.

An investigation was planned for the purpose of determining the effect of spraying potato vines with Bordeaux mixture on the starch content of the tubers. As starch accumulates most rapidly when the plant is maturing, it seemed reasonable to assume that if spraying prevented blight and prolonged the life of the plant to its natural period of growth, the tubers would be of better quality with a larger proportion of starch than those from immature plants. Aroostook county being the great potato county of the State, where large starch factories are located, arrangements were made in the fall of 1898, with growers in that section to supply us with potatoes from sprayed and unsprayed fields.

The samples were selected by the growers and only merchantable potatoes were taken for analysis. About the time that we were preparing to begin the analyses, Dr. Wiley, Chief Chemist of the U. S. Department of Agriculture, visited the State to study the starch factories of Aroostook. He kindly offered to have the analyses of the potatoes made in his laboratory, and the samples were accordingly forwarded to Washington. The Department laboratory was being entirely rebuilt at that time and this occasioned so much delay in the analyses that the results were not received until the growing season was well begun and it was, therefore, deemed best to defer the publication until the present time.

The description of the samples and the results of the analyses as found by the Chemical Division of the U. S. Department of Agriculture follow:

DESCRIPTION OF POTATO SAMPLES.

No. 3036, *Beauty of Hebron.* Grown by C. H. Richardson, Fort Fairfield; sample was taken from a field of eight acres which had been in pasture since being cleared until 1896. In 1896 it bore a heavy crop of potatoes without any rust; in 1897, it was again planted to potatoes with a light yield and an early rust. The yield in 1896 was about 100 barrels per acre and in 1897 about 50 barrels. The soil is light red loam and, like most land in that vicinity, is on a shell-like lime rock ledge. The field was plowed in the fall of 1897, and harrowed three times in the spring with a spring toothed harrow. It was planted with a planter and hoed with a horse hoe. The field had received no manure until in 1896 and that year, and in 1897 and in 1898 it received about 500 pounds of complete fertilizer per acre. In 1898, the crop was planted May 19 and harvested between September 1 and 20.

The crop was sprayed twice with Bordeaux mixture, July 30 and August 9, but it was too late to save the plants from the blight. The yield was about fifty barrels of merchantable potatoes and fifteen barrels of small ones, per acre.

No. 3037, *Beauty of Hebron.* These potatoes were taken from a field adjoining that from which No. 3036 were taken. The field was plowed for the first time in the fall of 1897 and the crop was grown on the sod without the addition of any fertilizing materials.

Nos. 3038 *and* 3039, *White Elephant and* 3040 *and* 3041, *Delaware.* These samples were from T. B. Bradford, Golden Ridge, Sherman, Maine. The land had a slope to the north; had been in grass until October, 1897, when it was plowed. The soil was dark soil, inclined to be wet, and was not underdrained. The sub-soil was gravelly. It received about ten two-horse loads of barn manure, broadcast, over the field and about 500 pounds of fertilizer per acre; the fertilizer was applied in the drill. The field was planted June 1 and harvested September 28. The whole field was sprayed three times with Bordeaux mixture by the use of an Aspinwall Sprayer; in addition to this, sample No. 3038 was sprayed more with a knapsack sprayer. At the time that had been sprayed five times, the others were killed by rust. There were forty-five barrels of merchantable potatoes and seventy-five barrels of small potatoes per acre. All of the potatoes rotted very badly, and the decay began before any of the leaves were killed.

Nos. 3044 *and* 3045, *White Elephant.* These samples were received without the name of the sender. Three thousand forty-four was not sprayed and 3045 was sprayed with Bordeaux mixture.

Nos. 3046 *and* 3047, *White Elephant.* These were grown by R. S. Hoyt of Fort Fairfield. The field has a slope to the northeast and was in pasture previous to 1896. In 1897, a crop of potatoes was grown with the addition of 300 pounds of fertilizer. The yield was about sixty barrels. The field was plowed again in October, 1897, harrowed May 20, 1898, planted May 24 and harvested September 21. Four hundred pounds of complete fertilizer were used, applied in the drill. The part from which No. 3046 was taken, was sprayed twice, and 3047 was not sprayed. The yield was sixty-five barrels of merchantable potatoes and twenty-five barrels of small potatoes per acre.

Nos. 3050 *and* 3051, *White Elephant.* Grown by Powers Bros. of Caribou. The field bore potatoes in 1895; was seeded to oats in 1896 and grew a crop of red clover in 1897. The soil is a medium light clay loam with a gravelly sub-soil. The field was plowed in October, 1897, and harrowed in the spring. Four hundred pounds commercial fertilizer was applied in the drill, and the piece was planted May 15-19 and harvested September 20-25. The field was sprayed three times but finally succumbed to the blight. The yield was sixty barrels of merchantable potatoes and thirteen barrels of small ones per acre. Number 3051 was from an unsprayed portion of the field.

Nos. 3052 *and* 3053, *Delawares.* The name of the sender and the culture is not known, except that 3052 was sprayed with Bordeaux mixture and 3053 was unsprayed.

Nos. 3054 *and* 3055, *Carmen.* These were from the same person as 3052 and 3053. No. 3054 was sprayed with Bordeaux mixture and 3055 was unsprayed.

ANALYSIS OF POTATOES GROWN IN 1898, THE RESULTS CALCULATED TO WATER CONTENT AT TIME OF SAMPLING.*

Variety.	Laboratory No.	Water.	Starch.	Fiber.	Protein nitrogen X 6.25.	Ash.	Total.	Specific gravity.
		%	%	%	%	%	%	
Hebron	3036	79.72	16.94	0.90	2.12	0.76	100.44	1.0604
Hebron	3037	78.13	18.59	0.72	2.06	0.78	100.28	1.0795
White Elephant	3038	76.81	19.96	0.84	2.19	0.99	100.79	1.0867
White Elephant	3039	76.92	20.38	0.90	2.31	0.87	101.38	1.0742
White Elephant	3044	78.74	15.96	0.64	2.25	0.92	98.51	1.0803
White Elephant	3045	75.21	19.31	0.61	2.12	0.83	98.02	1.1058
White Elephant	3046	75.88	18.81	0.56	2.25	0.96	98.46	1.0921
White Elephant	3047	77.44	18.12	0.63	2.06	0.88	99.13	1.0906
White Elephant	3050	75.56	18.14	0.56	1.81	1.04	97.11	1.1129
White Elephant	3051	78.13	18.62	0.63	1.75	0.98	100.11	1.0881
Delaware	3040	76.02	19.20	0.61	2.06	1.01	98.90	1.0852
Delaware	3041	76.93	18.63	0.61	2.19	0.94	99.30	1.0904
Delaware	3052	75.72	18.63	0.55	2.31	0.95	98.16	1.0745
Delaware	3053	77.64	16.26	0.61	2.56	0.91	97.98	1.1120
Carmen	3054	76.87	18.03	0.66	2.06	0.90	98.52	1.0967
Carmen	3055	76.57	17.07	0.59	2.38	0.76	97.37	1.0804

*The analyses were made by the Chemical Division of the U. S. Department of Agriculture.

As these results are not given in the usual form of food analyses, they are presented in that form on both the fresh and water free basis in the tables which follow. As the fat was not determined, it is included with the carbohydrates. It will be seen that the starch as determined, as given in the table on page 147, exceeds in several instances, the combined carbohydrates and fat, as given on page 149. These discrepancies are due to the fact that the analytical methods have in several cases given too high results, carrying the total above 100 per cent, while in the second table, the carbohydrates and fat are calculated by difference. The average of 136 analyses, as compiled in Bulletin 28 of the Office of Experiment Stations of the United States Department of Agriculture, is added for comparison:

ANALYSES OF POTATOES.

RESULTS CALCULATED TO WATER-FREE BASIS.

Variety.	Laboratory number.	Ash.	Protein.	Fiber.	Carbohydrates and fat.
		%	%	%	%
Hebron	3036	3.75	10.45	4.44	81.36
Hebron	3037	3.57	9.42	3.29	83.72
Average	....	3.66	9.94	3.86	82.54
White Elephant	3038	4.27	9.44	3.62	82.67
White Elephant	3039	3.77	10.01	3.90	82.32
White Elephant	3044	4.33	10.58	3.01	82.08
White Elephant	3045	3.35	8.55	2.46	85.64
White Elephant	3046	3.98	9.33	2.32	84.37
White Elephant	3047	3.90	9.13	2.79	84.18
White Elephant	3050	4.26	7.41	2.29	86.04
White Elephant	3051	4.48	8.00	2.88	84.64
Average	....	4.04	9.06	2.91	83.99
Delaware	3040	4.21	8.59	2.54	84.66
Delaware	3041	4.07	9.49	2.65	83.79
Delaware	3052	3.91	9.51	2.27	84.31
Delaware	3053	4.07	11.45	2.73	81.75
Average	....	4.06	9.76	2.55	83.63
Carmen	3054	3.89	8.91	2.85	84.35
Carmen	3055	3.24	10.16	2.52	84.08
Average	....	3.57	9.53	2.69	84.21
Average of 136 samples*	....	4.61	10.14	1.84	83.41

* Bulletin 28 of the Office of Experiment Stations.

ANALYSES OF POTATOES.

RESULTS CALCULATED TO WATER CONTENT AT TIME OF SAMPLING.

Variety.	Laboratory No.	Water.	Ash.	Protein.	Fiber.	Carbohydrates and fat.
		%	%	%	%	%
Hebron	3036	79.72	.76	2.12	.90	16.50
Hebron	3037	78.13	.78	2.06	.72	18.31
Average		78.92	.77	2.09	.81	17.41
White Elephant	3038	76.81	.99	2.19	.84	19.17
White Elephant	3039	76.92	.87	2.31	.90	19.00
White Elephant	3044	78.74	.92	2.25	.64	17.45
White Elephant	3045	75.21	83	2.12	.61	21.23
White Elephant	3046	75.88	.96	2.25	.56	20.35
White Elephant	3047	77.44	.88	2.06	.63	18.99
White Elephant	3050	75.56	1.04	1.81	.56	21.03
White Elephant	3051	78.13	.98	1.75	.63	18.51
Average		76.84	.93	2.09	.67	19.47
Delaware	3040	76.02	1.01	2 06	.61	20.30
Delaware	3041	76.93	.94	2.19	.61	19.33
Delaware	3052	75.72	.95	2.31	.55	20.47
Delaware	3053	77.64	.91	2.56	.61	18.28
Average		76.58	.95	2.28	.60	19.59
Carmen	3054	76.87	.90	2.06	.66	19.51
Carmen	3055	76.57	.76	2.38	.59	19.70
Average		76.72	.83	2.22	.63	19.60
Average of 136 analyses*		78.30	1.00	2.20	.40	18.10

* Bulletin 28 of the Office of Experiment Stations.

ANALYSES OF THE ASH OF POTATOES.

In four samples large quantities of the ash were obtained for analysis. These analyses were also made by the Chemical Division of the United States Department of Agriculture. The results follow:

PERCENTAGES OF IMPURITIES (CARBON, SAND AND SILICA) AND PURE ASH IN THE CRUDE ASH.

Sample number.	Impurities.	Pure Ash.
	%	%
3045	9.36	90.64
3047	12.32	87.68
3050	5.14	94.86
3051	7.04	92.96

ANALYSIS OF PURE ASH OF POTATOES.

Sample number.	Potash, K_2O.	Soda, Na_2O.	Lime, CaO.	Magnesia, MgO.	Phosphoric acid, P_2O_5.	Sulphuric acid, SO_3.
	%	%	%	%	%	%
3045	55.13	1.70	1.01	3.85	15.78	6.92
3047	56.16	1.62	1.38	3.93	14.50	5.98
3050	56.43	1.70	1.29	3.76	15.00	6.38
3051	57.30	2.15	1.05	3.57	13.33	5.56

RELATION BETWEEN STARCH CONTENT AND SPECIFIC GRAVITY.

The specific gravity of starch is 1.65, water being taken as one. From this it would seem to follow that the richer a potato is in starch, the higher will be its specific gravity. From this assumption, a German agricultural calendar* has for years published a table giving the starch content of potatoes corresponding to various specific gravities. Assuming this method to be reliable, one of the best experiment stations in the United States has made an otherwise valuable investigation of little account. In Wiley's Principles and Practice of Agricultural Analysis, the unreliability of this method for scientific purposes is pointed out. The figures obtained in the analyses here reported, show in a striking manner the unreliability of the specific gravity method of determining starch in potatoes. In only one instance, (No. 3045) is there a practical agreement between the starch determined chemically and that found by the specific gravity method. Number 3036 has the lowest specific gravity of any of the samples examined, and 3053 has the next to the highest. Number 3036 carries 16.94 per cent while 3053 has only 16.26 per cent. As found by specific gravity, 3036 would have only ten per cent of starch and 3053 would have over twenty per cent. In the table which follows the samples are arranged according to their specific gravities.

---

* Mentzel und v. Lengerke's Landw. Huelfs und Schreib-Kalender.

TABLE SHOWING ABSENCE OF RELATION BETWEEN SPECIFIC GRAVITY AND STARCH CONTENT OF POTATOES.

Sample number.	Specific gravity.	Starch by specific gravity.	Starch directly determined.
		%	%
3036	1.0604	10.1	16.94
3039	1.0742	12.7	20.38
3052	1.0745	12.9	18.63
3037	1.0795	13.8	18.59
3044	1.0803	13.9	15.96
3055	1.0804	13.9	17.07
3040	1.0852	15.0	19.20
3038	1.0867	15.3	19.96
3051	1.0881	15.6	18.62
3041	1.0904	16.1	18.63
3047	1.0906	16.2	18.12
3046	1.0921	16.4	18.81
3054	1.0967	17.5	18.03
3045	1.1058	19.4	19.31
3053	1.1120	20.7	16.26
3050	1.1129	20.9	18.14

EFFECT OF SPRAYING UPON THE STARCH CONTENT OF POTATOES.

As before stated, this investigation was begun with the express purpose of studying the effect of spraying upon the starch content of the potatoes. Owing to the fact that in most instances the spraying was begun so late that none of the potatoes here sampled completely escaped the attack of the blight, it was thought that very little, if any, difference would be found between the starch content of potatoes whose vines were sprayed with Bordeaux mixture and those unsprayed. Theoretically, anything which prolongs the growing season ought to increase the amount of starch which will be stored up in the potato; hence, if vines sprayed with Bordeaux mixture live longer than those not treated, not only should the yield of potatoes be larger, but the percentage of starch should be higher.

PERCENTAGES OF STARCH IN SPRAYED AND UNSPRAYED POTATOES.

Variety of potatoes.	Sprayed.		Unsprayed.	
	Sample No.	Starch.	Sample No.	Starch.
		%		%
White Elephant	3038	19.96	......	....
	3039	20.38	......	....
	3045	19.31	3044	15.96
	3046	18.81	3047	18.12
	3050	18.14	3051	18.62
Average	......	19.32	......	17.52
Delaware	3040	19.20	3041	18.63
	3052	18.63	3053	16.26
Average	......	18.92	......	17.45
Carmen No. 1	3054	18.03	3055	17.07
Average of all	......	19.06	......	17.43

In the case of the Hebron potatoes, the unsprayed had a larger starch content than the sprayed. From the description of the samples, it will be noted that the field from which the sprayed potatoes were taken had been planted to this crop for three years, while the unsprayed was on sod, and that the growing time of the plants was not prolonged by the spraying. In the other instances, spraying seemed to increase the percentage of starch in the tubers. The four samples of White Elephant potatoes which had been sprayed, contained 19.3 per cent of starch, while the three samples of the same variety unsprayed had on the average only 17.5 per cent. The two samples of sprayed Delawares had 18.9 per cent and the unsprayed 17.4 per cent of starch, and the one sample of sprayed Carmen had 18.0 per cent against 17.1 per cent for the unsprayed. So far as these cases go, they seem to indicate that spraying with Bordeaux mixture not only prolonged the life of the vines, but that sprayed potatoes contained higher percentages of starch than unsprayed.

The results of a single experiment at Kalmaes Agricultural College, Norway, gave results indicating a very beneficial influence from Bordeaux mixture, both in yield and in starch content of the potatoes grown. The condensed results were as follows:*

	Yield per acre.	Starch content.
	Lbs.	%
Potatoes not treated with Bordeaux mixture...............	1,426	13.9
Potatoes treated once with Bordeaux mixture	2,116	14.3
Potatoes treated twice with Bordeaux mixture..................	2,858	16.3

THE STARCH CONTENT OF AROOSTOOK GROWN POTATOES COMPARED WITH THAT OF POTATOES GROWN ELSEWHERE.

The sixteen samples here reported upon were found to carry an average of 18.29 per cent of starch. The percentages ranged from 15.96 to 20.38 per cent. Two of the samples carried about 16 per cent, two about 17, two about 19 and two about 20 per cent. The other samples had about 18 per cent. The eight sprayed samples had an average of 19.06 per cent and the unsprayed had an average of 17.43 per cent of starch. It is probable that the crop of 1898 did not average much above that of the unsprayed samples here reported upon.

In 1890, the Utah Experiment Station† made sixteen analyses of potatoes in which the starch ran abnormally high. In 1894 and 1895, the same station made about seventy-five analyses in which the starch content varied from a minimum of 10.17 per cent to a maximum of 22.49, with an average of about 17 per cent.

The analyses of something over 200 samples of potatoes by the West Virginia Experiment Station‡ show a range in starch from 13.46 per cent to 21.43 per cent. Only four of the samples contained twenty per cent or above of starch and fourteen had less than fifteen per cent. The greater number of the samples carried between 15.50 and 17.50 per cent. The average was 16.50 per cent.

---

* Experiment Station Record, Vol. 8, p. 122.

† Report of Utah Experiment Station for 1896, pp. 21 to 25.

‡ Report of West Virginia Experiment Station, 1896, pp. 50-57.

In fifteen samples of Norwegian grown potatoes,* the starch ranged from 12.3 to 20.3 per cent with an average of 14.91 per cent. In still another lot of Norwegian potatoes† consisting of 122 samples, 20 samples contained less than 13.19 per cent of starch, 22 samples contained less than 14.15 per cent, 38 samples contained less than 15.06 per cent of starch and 42 samples had over 17 per cent. The highest percentage found was 20.59 per cent.

The average of 20 samples examined by the Halle (Germany) Experiment Station was 19.77 per cent of starch with a range from 17.72 to 22.78 per cent.

From the above comparisons it is evident that the potatoes which were sprayed were full higher in starch than most others which have been examined. If the per cent and a half more of starch found in the sprayed than in the unsprayed potatoes was due to the treatment of the vines, and no other explanation suggests itself, this alone is a strong argument in favor of spraying.

FERTILIZING MATERIALS REMOVED BY A CROP OF POTATOES.

Ash analyses of four samples of the potatoes are given on page 150. These results, calculated to the fresh potato, are given in the table which follows:

FERTILIZING CONSTITUENTS OF POTATOES CALCULATED TO WATER CONTENT OF FRESH POTATOES.

Variety.	Laboratory number.	Nitrogen.	Phosphoric acid.	Potash.	Lime.
		%	%	%	%
White Elephant	3045	.34	.12	.41	.01
White Elephant	3047	.33	.11	.43	.01
White Elephant	3050	.29	.15	.56	.01
White Elephant	3051	.28	.12	.52	.01
Average	....	.31	.13	.48	.01

---

* Experiment Station Record, Vol. 6, p. 410.

† Experiment Station Record, Vol. 5, p. 1017.

In the Year Book of the United States Department of Agriculture for 1896, are given figures which agree very closely with the above. These are compiled results and from the close agreement it would seem to indicate that the composition of potatoes, so far as nitrogen, phosphoric acid and potash are concerned, is fairly uniform.

Assuming these figures to fairly represent potatoes as grown in Maine, a crop of 200 bushels, weighing six tons, would remove thirty-seven pounds of nitrogen, sixteen pounds of phosphoric acid and fifty-eight pounds of potash.

If the amounts and proportions of fertilizing elements removed by a crop could be taken as a guide in preparing a field for that crop, the problem of supplying the proper amount and kind of plant food to the soil would be much simplified. To manure a field for a crop of potatoes, nitrogen, phosphoric acid and potash would have to be added in about the proportions given above and in sufficient quantity to supply the vines and tubers the land was expected to yield. A formula made up on this basis would be very materially different from any mixed fertilizer on the market and would contain the fertilizing elements in about the following proportions: Nitrogen, 5 parts; phosphoric acid, 2 parts; and potash, 8 parts. Twenty-six different brands of so-called potato fertilizers were sold in the State in 1899. The table which follows show how these goods were made up:

COMPOSITION OF SO-CALLED POTATO FERTILIZERS SOLD IN MAINE IN 1899.

	Nitrogen.	Available phosphoric acid.	Potash.
	%	%	%
12 brands	1.5—2.5	8—9	2 3.25
6 brands	2—2.5	6—9	4—6
8 brands	2.5—3.5	5.5—8	7—10

The first twelve brands mentioned cannot properly be called potato or special fertilizers as their composition is practically the same as all general purpose goods. The formulas of the last eight, approximate more nearly to the popular idea of what a potato manure should be, but even these carry much more phosphoric acid in proportion to the nitrogen and potash they contain than is found in the plants or in farmyard manure.

It is possible that in using commercial fertilizers, more phosphoric acid is applied than is needed in many cases, yet there is not much evidence at hand in the form of accurate experimental data to prove this assertion. Many experiments have been made both in this country and Europe in growing potatoes with commercial fertilizers and chemicals, but very few experimenters have made a study of the relative proportions of the fertilizing elements that can be most profitably used.

L. Hecke[*] in his quite extensive experiments with chemicals on the potato plant found that it needed, throughout its entire period of growth, liberal supplies of all fertilizing elements. The demand for nitrogen was especially strong in the first half, and for potash in the last half of the season. The application of potash had a marked influence on the production of tubers and starch. Phosphoric acid had less effect, probably because the soil was quite rich in phosphates.

Experiments are reported by the New York Experiment Station,,[†] in which the primary object was to determine the profitable amount of fertilizer to apply. Two formulas were used, one of which carried approximately nitrogen 4%, phosphoric acid 8.2%, potash 10%; the other, nitrogen 6.5%, phosphoric acid 4.8%, potash 10%. 'The quantities applied were the same for each formula, being 500, 1,000, 1,500 and 2,000 pounds per acre. One thousand pounds per acre of either kind yielded the largest profit, but the one carrying the most phosphoric acid gave the largest yields in every case; the greatest difference occurring when but 500 pounds were used, and least when 2,000 pounds were applied per acre. As the mixture high in phosphoric acid cost several dollars per ton less, on account of containing less nitrogen, it was more profitable than the other.

Experiments were made at the Kentucky Experiment Station[‡] on a limestone soil quite rich in phosphoric acid, in growing potatoes with chemicals. The best yield was obtained when the three elements, nitrogen, phosphoric acid, and potash were used.

---

[*] Jour. Landw. 43 (1895) p. 285.

[†] Bulletin 137, 1897.

[‡] Bulletin 55.

Much better crops were obtained when phosphoric acid and potash were used than when potash was used alone or with nitrogen only. The chemicals were added in the proportion of nitrogen 25.6 pounds, phosphoric acid 57 pounds and potash 80 pounds per acre, or if mixed, the composition would be nitrogen 5.5%, phosphoric acid 12.4%, potash 17%.

The Connecticut Experiment Station* made experiments to compare the effect of muriate with that of sulphate of potash on the starch content and yield of tubers. The potatoes were grown on very poor soil which was dressed with 400 pounds nitrate soda, 615 pounds acid phosphate and 120 pounds of muriate or sulphate of potash. The yield was increased from 43 to 228 bushels of salable tubers per acre. Doubling the potash, applying 240 pounds per acre, increased the yield only twelve bushels per acre over what was produced when 120 pounds were applied. Muriate produced a somewhat greater yield than sulphate, but the tubers contained slightly more water and less starch than when sulphate was used.

The evidence in regard to the relative effect of sulphate and muriate of potash on potatoes is somewhat conflicting. Most of the experiments made in this country and Europe show that sulphate produces better tubers with less water and a slightly higher starch content, but the difference is slight. Some German experimenters, Pfeiffer† and others, have recently published results of experiments showing that pure muriate has no injurious effect on the tubers, but impurities, noticeably chloride of magnesia, are influential in depressing the proportion of starch.

An analysis of the ash of the potato shows it to be exceedingly rich in potash, and the fact has led many to believe that a potato manure should contain a large amount of this element, but when we consider the small amount of ash a potato contains, we find the amount removed by an ordinary crop (58 pounds) is not greater than is taken up by any other farm crops. Two tons of mixed hay would take away sixty-three pounds, while two tons of red clover would take eighty-eight pounds of potash.

In preparing a field for any crop it is more essential to consider the special needs of the soil, to render it fertile, than the special needs of the crop to be grown upon it. While it is true that some plants take up more of some one element than others, the difference is insignificant when compared with the difference in soils. The soils of Maine are extremely variable in character and composition and it is therefore impracticable to make a fertilizer formula for potatoes or any other crop that would be applicable in all cases. Each farmer who uses commercial fertilizers extensively should experiment with unmixed goods enough to determine to what elements his soil most readily and profitably responds. Some marl or limestone soils are quite rich in phosphoric acid and consequently a fertilizer containing a small amount of that element and relatively large amounts of nitrogen and potash would give best results, while some of our granite soils and clay loams are quite rich in potash and respond best to a fertilizer containing relatively large amount of phosphoric acid.

---

* Report 1895, p. 124.

† Die Land. Vers. Stat. Bd. 49, p. 49.

A study of the experimental data indicates that the potato plant thrives best in a rich soil which is abundantly supplied with all fertilizing elements. In the early stages of its growth, when the vines are forming, the demand for nitrogen is particularly large, and for this reason a potato fertilizer should contain quite a part of its nitrogen in a soluble, immediately available form. Later in the season, when the tubers are forming, large amounts of phosphoric acid and potash are required, also a bountiful supply of water to take up the plant food, etc., and transmit it through the vines.

ACKNOWLEDGMENTS.

Acknowledgment is hereby made for the following gifts to the Station during 1899:

Set Economic Seeds, Seed Potatoes—United States Department of Agriculture.

Apple Cions—Jules Lagace, Van Buren.

Kerowater Spraying Apparatus—Gould's Manufacturing Co., Seneca Falls, N. Y.

Copper Electric Sprayer—A. L. & E. F. Goss, Lewiston.

Spray Pump—Deming Co., Salem, Ohio.

Spray Pump—Morrell & Morley, Benton Harbor, Mich.

Paragrene—F. L. Lavenburg, New York City.

Green Arsenite, Green Arsenoid, Pink Arsenoid—Adler Color and Chemical Works, N. Y.

Prepared Bordeaux Mixture and Bordeaux Paint—Lennox Spraying Co., Pittsfield, Mass.

Special Laurel Green—Nichols Chemical Company, N. Y.

Sulphate, Muriate and Carbonate of Potash, and Kainit—German Kali Works, New York City.

Guano and Bone—Bowker Fertilizing Co., Boston, Mass.

Low Farm Wagon—Electric Wheel Co., Quincy, Ill.

Reliable Nest Box—M. L. Newell, Denver, Colo.

Calf Dehorner—Bullock Manufacturing Co., Flint, Mich.

Scythes—Nolin Manufacturing Co., Skowhegan.

Ground Oyster Shells—Poultry and Farm Supply Co., Boston.

The following newspapers and other publications are kindly donated to the Station by the publishers:

Agricultural Epitomist, Indianapolis, Ind.

Agricultural Gazette, Sidney, New South Wales.

American Cultivator, Boston, Mass.

American Fertilizer, Philadelphia, Pa.

American Florist, Chicago, Ill.

American Gardening, New York City.

American Grange Bulletin, Cincinnati, O.

American Grocer, New York City.
American Miller, Chicago, Ill.
Baltimore Weekly Sun, Baltimore, Md.
Bangor Weekly Commercial, Bangor, Me.
Breeders' Journal, Himrods, N. Y.
Canadian Horticulturist, Grimsby, Ont.
Chronique Agricole, Lausanne, Switzerland.
Country Gentleman, Albany, N. Y.
Dairy World, Chicago, Ill.
Detroit Free Press, Detroit, Mich.
Elgin Dairy Report, Elgin, Ill.
Farm, Furnace and Factory, Roanoke, Va.
Farmer's Advocate, Burlington, Vt.
Farmer's Advocate, London, Ont.
Farmer's Guide, Huntington, Ind.
Farmer's Home, Dayton, O.
Farm Home, Springfield, Ill.
Farmers' Tribune, Des Moines, Iowa.
Farm and Home, Chicago, Ill.
Farm Journal, Philadelphia, Pa.
Farm-Poultry, Boston, Mass.
Farmer's Magazine, Springfield, Ill.
Farmer's Review, Chicago, Ill.
Farmer's Voice, Chicago, Ill.
Farming, Dayton, O.
Florists Exchange, New York City.
Forester, Princeton, N. J.
Fruit, Dunkirk, N. Y.
Green's Fruit Grower, Rochester, N. Y.
Hoard's Dairyman, Ft. Atkinson, Wis.
Holstein Friesian Register, Brattleboro, Vt.
Homestead, Des Moines, Iowa.
Horticultural Visitor, Kinmundy, Ill.
Jersey Bulletin, Indianapolis, Ind.
Journal of the Royal Agricultural Society, London, England.
Louisiana Planter, New Orleans, La.
Lewiston Weekly Journal, Lewiston, Maine.
Maine Farmer, Augusta, Me.
Mark Lane's Express, London, England.
Market Basket, Philadelphia, Pa.

Market Garden, Minneapolis, Minn.
Massachusetts Ploughman, Boston, Mass.
Michigan Fruit Grower, Grand Rapids, Mich.
Mirror & Farmer, Manchester, N. H.
Montana Fruit Grower, Missoula, Mont.
National Farmer and Stock Grower, National Stock Yards, Ill.
National Rural and Family Magazine, Chicago, Ill.
New England Farmer, Boston, Mass.
New England Florist, Boston, Mass.
New England Homestead, Springfield, Mass.
New York Farmer, Port Jervis, N. Y.
New York Produce Review, New York City.
North American Horticulturist, Monroe, Mich.
Northern Leader, Fort Fairfield, Me.
Northwestern Miller, Minneapolis, Minn.
Ohio Farmer, Cleveland, Ohio.
Oregon Agriculturist, Portland, Oregon.
Pacific Bee, Sacramento, Cal.
Pacific Coast Dairyman, Tacoma, Wash.
Park and Cemetery, Chicago, Ill.
Practical Farmer, Philadelphia, Pa.
Public Ledger, Philadelphia, Pa.
Ruralist, Gluckheim, Md.
Rural Californian, Los Angeles, Cal.
Rural New Yorker, New York City.
Rural Topics, Morgan City, La.
Southern Farm Magazine, Baltimore, Md.
Southern Farmer, New Orleans, La.
Southern Planter, Richmond, Va.
Southwest, Springfield, Mo.
Southwestern Farmer, Wichita, Kans.
Strawberry Specialist, Kittrell, N. C.
Sugar Beet, Philadelphia, Pa.
Turf, Farm and Home, Waterville, Me.
Vick's Magazine, Rochester, N. Y.
Weekly Union, Manchester, N. H.
Western Agriculturist, Chicago, Ill.
Western Creamery, San Francisco, Cal.
Western Fruit Grower, St. Joseph, Mo.
The World, Vancouver, B. C.

METEOROLOGICAL OBSERVATIONS.

The instruments used at this Station are the same as those used in preceding years, and include: Wet and dry bulb thermometers; maximum and minimum thermometers; thermograph; rain-gauge; self-recording anemometer; vane and barometer. The observations at Orono now form an almost unbroken record of thirty-one years.

The noticeable features of the year at this point were the warm month of December, which was 7.33 degrees warmer than the average; and the small rainfall of April, August, and November. In August the only rain which fell was in the form of light showers, the precipitation in each case being less than one-hundredth of an inch. The total rainfall for the year was 10.66 inches below the average for thirty-one years.

For the first nine months of the year, observations were made at 7 A. M., 2 P. M., and 9 P. M. Since October 1 the morning and evening observations have been discontinued. Latitude 44°, 54′, 2″ N. Longitude 68°, 40′, 11″ W. Elevation above the sea, 150 feet.

METEOROLOGICAL SUMMARY FOR 1899.

Observations Made at the Maine Experiment Station.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.	Total.
Highest barometer	30.58	30.28	30.60	30.16	30.13	30.15	30.11	30.18	30.32	30.36	30.31	30.37	30.30	.....
Lowest barometer	29.05	29.03	28.68	29.28	29.44	29.48	29.44	29.60	29.39	29.52	29.40	29.03	29.28	......
Mean barometer	29.86	29.75	29.77	29.83	29.84	29.78	29.75	29.84	29.88	30.04	29.80	29.84	29.83	......
Highest temperature	49°	52°	51°	84°	80°	87°	91°	93°	88°	76°	58°	57°	....	.....
Lowest temperature	—21°	—16°	—3°	18°	26°	37°	41°	40°	23°	22°	8°	—9°	....	......
Mean temperature	15°.95	16°.52	26°.47	43°.32	52°.27	62°.05	68°.40	66°.48	56°.59	49°.97	33°.99	28°.04	43°.34	......
Mean temperature for 31 years	15°.98	19°.24	27°.56	40°.26	52°.38	61°.98	66°.97	65°.05	57°.02	45°.81	34°.21	20°.71	42°.26	.....
Total precipitation in inches	2.75	2.27	4.76	.66	4.12	4.10	4.49	trace.	3.20	2.92	2.01	3.01	....	34.29
Mean precipitation for 31 years	4.22	4.05	4.19	2.85	3.46	3.61	3.36	3.64	3.37	4.00	4.44	3.76	....	44.95
No. of days with precip. of .01 in. or more	5	7	11	2	9	13	10	....	5	7	6	9	....	84
Snow fall in inches	10	13.5	28	0.5	....	....	....	....	....	....	7.5	6.5	....	66.0
Average snow fall for 31 years	23.1	21.8	17.1	6.0	....	....	....	....	....	1.0	7.8	16.9	....	93.7
Number of clear days	13	12	8	19	17	14	11	18	12	12	10	10	....	156
Number of fair days	12	7	8	10	5	10	9	4	6	4	4	4	....	83
Number of cloudy days	6	9	15	1	9	6	11	9	12	15	16	17	....	126
Total movement of wind in miles	6898	6744	8241	5391	6832	5547	5321	4352	5500	5021	4857	5489	....	......

REPORT OF THE TREASURER.

Maine Agricultural Experiment Station in account with the United States appropriation, 1898-9.

DR.

To receipts from the Treasurer of the United States as per appropriation for the fiscal year ending June 30, 1899, as per act of Congress approved March 2, 1887	$15,000 00

CR.

By salaries:		
(a) Director and administration officers	$2,194 26	
(b) Scientific staff	4,493 48	
(c) Assistants to scientific staff	1,215 13	
(d) Special and temporary services	51 96	
Total		$7,954 83
Labor:		
(a) Monthly employees	$450 00	
(b) Daily employees	1,319 66	
Total		1,769 66
Publications:		
For envelopes for bulletins and reports		229 93
Postage and stationery		357 61
Freight and express		154 62
Heat, light and water		829 67
Chemical supplies:		
(a) Chemicals	$197 06	
(b) Other supplies	201 18	
Total		398 24
Seeds, plants and sundry supplies:		
(a) Agricultural	$57 17	
(b) Horticultural	260 43	
(c) Botanical	10 00	
(e) Miscellaneous	83 50	
Total		411 10
Fertilizers		$71 45
Feeding stuffs		486 82
Library		279 83
Tools, implements, and machinery		544 42
Furniture and fixtures		242 09
Scientific apparatus		42 93

Live stock:		
(e) Poultry	$154 00	
(f) Sundries	143 55	
Total		$297 55
Traveling expenses:		
(a) In supervision of Station work	$118 77	
(b) In attending various meetings	60 48	
Total		179 25
Buildings and repairs:		
(a) New buildings		750 00
Total		$15,000 00

ISAIAH K. STETSON, *Treasurer.*

I, the undersigned, duly appointed Auditor of the Corporation, do hereby certify that I have examined the books of the Maine Agricultural Experiment Station for the fiscal year ending June 30, 1899; that I have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements, $15,000.00; for all of which proper vouchers are on file and have been examined by me and found correct.

And I further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887.

A. W. HARRIS, *Auditor.*

Maine Agricultural Experiment Station in account with Fertilizer Inspection for the year ending December 31, 1899.

Dr.		
To receipts for licenses		$2,805 00
Cr.		
By balance from account of 1898	$20 04	
Collection and analyses of samples	1,831 27	
Executive and office expenses	700 00	
Balance to account of 1900	253 69	$2,805 00

Maine Agricultural Experiment Station in account with Feed Inspection for the year ending December 31, 1899.

Dr.		
To receipts for inspection tags, 1899	$2,112 19	
Balance to account of 1899	786 07	$2,898 26
Cr.		
By balance carried from 1898 account	$1,014 01	
Collection and analyses of samples	773 48	
Tags	410 77	
Executive and office expenses	700 00	2,898 26

Maine Agricultural Experiment Station in account with Creamery Inspection for the year ending December 31, 1899.

DR.

To fees for calibrating glassware	$53 34

CR.

By expense calibrating glassware	$53 34

Maine Agricultural Experiment Station in account with "General Account" for the year ending June 30, 1899.

DR.

To balance from 1897-8	$798 54	
Sales of produce, etc	2,425 58	$3,224 12

CR.

By labor	$292 54	
Freight and express	32 10	
Seeds, plants, and sundry supplies	75 23	
Feeding stuffs	61 57	
Library	10 90	
Tools, implements and machinery	30 79	
Furniture and fixtures	8 10	
Scientific apparatus	43 13	
Live stock	114 25	
Traveling expenses	25 28	
Contingent (chiefly insurance)	424 01	
Buildings and repairs	800 93	
Balance to 1899-1900 account	1,305 29	3,224 12

INDEX.

PAGE
Acknowledgments 159
Acorn bread, composition 80
meal, composition 80
Acorns, composition.. 80
Almond, composition.. 72
Amygdalus communis 72
Anisopteryx pometaria 128
Announcements 7
Aphis, apple tree 129
mali 129
Apple insects of Maine.. 107
maggot 136
Apple orchard, care of.. 23
Apple-tree tent caterpillar.. 120
Arachis hypogœa 77
Ash of potatoes, analyses.. 150
Bark louse, oyster-shell 110
Beneficial insects 107
Bertholletia excelsa 73
Beechnut, composition 80
Blatchford's calf meal.. 20
Borer, flat-headed 109
round-headed 108
Breakfast foods, cereal 93
Bucculatrix, apple leaf 125
Pomifoliella 125
Bud moth 114
Butternut, composition 81
Brazil nut, composition 73
Breakfast foods, cereal 93
Cacœcia rosana 116
Canker worm, fall 128
Curculio, plum 134
Carpocapsa pomonella 133
Castanea dentata 76
Cecropia emperor moth.. 132
Cereal breakfast foods 93
foods compared with milk and flour.. 106

PAGE
Chestnut, composition 77
Chinese nut, composition 83
Chrysobothris femorata 109
Clisiocampa Americana 120
 disstria 118
Cocoanut, composition 82
Cocos nucifera 81
Codling moth 133
Conotrachelus nenuphar 134
Corn preparations 98
Corylus 73
Cottonseed meal 18
 low grade 44
Emperor moth 132
English walnut, composition 75
Fagus Americana 80
Fall canker worm 128
 web worm 121
Feeding stuff analyses 11, 39
 free analysis 22, 50
 inspection 9, 37
Feeding stuffs, directions for sampling 50
Fertilizer analyses 63
 inspection 29, 57
 law, provisions 36
Fertilizers below guarantee 59
 manufacturers' samples 29
 for potatoes, composition 155
Fertilizer valuations 60
Filbert, composition 73
Flat-headed borer 109
Food, nuts as 71
 uses in the body 85
Foods, cereal breakfast 93
Forest tent caterpillar 118
Gluten feeds 19
 foods, composition 96
 meal 45
 meals and feeds 18
 preparations 104
Grafting 25
Grape nuts 103
Hickory-nut, composition 74
Hicoria ovata 74
 pecan 74
Hominy, composition 96
Hybernia tillaria 123
Hyphantria cunea 121
Ichneumon flies 107

PAGE

Insects affecting foliage of the apple tree 114
  the apple 107
  trunk and branches of the apple tree 108
Inspection, feeding stuff 9, 37
  fertilizers 29, 57
Juglans Californica 75
  cinerea 81
  nigra 75
  regia 75
Lady birds 107
Law, feeding stuff, requirements 21
Leaf folder, lesser 117
Leaf roller, oblique-banded 116
Leechee nut, composition 83
Lesser apple leaf folder 117
Letter of transmittal 3
Licensed fertilizers not found 59
Lime tree winter moth 123
Linseed meal 19
Litchi nut, composition 83
Meteorological observations 162
Mytilaspis pomorum 110
Nephelium litchi 82
Nuts as food 71
Nuts, average composition 87
  chemical composition 72
  compared with flour 88
  digestibility 91
  preparation and use 91
Oat feeds 20
  meals, composition 96
    uncooked 98
  preparations, cooked 99
Oats, rolled, composition 96
Oblique-banded leaf roller 116
Œdemasia concinna 130
Oil-nut, composition 81
Orchards, care 23
  culture 26
  fertilizing 26
  renovation 23
  spraying 27
Orchard work at the Station 28
Organization, Station 4
Orgyia leucostigma 126
Oyster-shell bark louse 110
Peanut, composition 79
  butter, composition 79

PAGE
Pear blight beetle 112
Pecan, composition 75
Pignolias, composition 83
Pine nuts, composition 83
Piñons, composition 83
Pistachia vera 84
Pistachio, composition 84
Platysamia cecropia 132
Plum curculio 134
Potato ash, analysis 150
  fertilizers, composition 155
Potatoes, analyses 147
  experiments with 145
  fertilizers required 156
  fertilizing constituents 154
  German, starch content 154
  Norwegian, starch content 153, 154
  of Aroostook county 153
  specific gravity 151
  starch content 147
Pulications, requests for 2
Quercus Emoryi 79
Railroad worm 136
Red-humped apple tree caterpillar 130
Rolled oats, composition 96
  wheat, composition 96
Round-headed borer 108
Saperda candida 108
Schizoneura lanigera 113
Shot-borer 112
Spraying apparatus 55
  effect on potatoes 145
  materials 54
Bordeaux mixture 54
Spraying of plants 51
  orchards 27
  when and how done 53
Starch in sprayed potatoes 152
  potato 145
Station organization 4
Syrphus flies 107
Tachina flies 107
Tent caterpillar, apple tree 120
  forest 118
Teras minuta 177
Tmetocera ocellana 114
Transmittal, letter of 3
Treasurer, report 164
Trypeta pomonella 136

PAGE
Tussock moth, white-marked 126
Valuations, fertilizer 60
Walnut, English, composition 75
  white, composition 81
Weather report 163
Web worm, fall 121
Wheat breakfast foods, composition 96
  preparations 99
  rolled, composition 96
White-marked tussock moth 126
Woolly louse 113
Xyleborus pyri 112